American Machinist

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The four operations exemplified in the illustration are: cut-off, expand, close end, and forge boss. Three of the operations are performed at a single heat. This process is an example of the one used for closing the ends of large cracking vessels, except that they are forged instead of spun. By reheating to a welding temperature, the end of a pipe may be entirely closed

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HOT-SPINNING HEMISPHERES

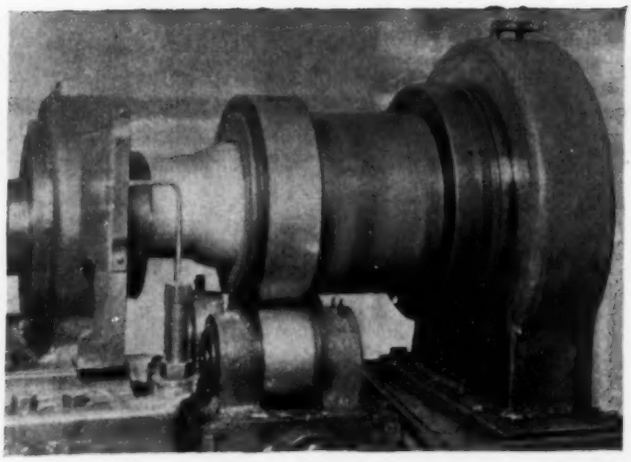
IT SEEMS ODD that a hemisphere should be the most difficult shape to form mechanically. We cannot draw it in a die, without wrinkles, we cannot shape it from a tube in a press; we can neither turn it without special attachments nor grind it with precision. Many shapes can be spun from flat sheet metal without interior support, but a hemisphere is not one of them.

The adoption of a hemisphere to crown the Cleco Gruss Air Spring was, therefore, in the nature of a challenge to the mechanical department of the Cleveland Pneumatic Tool Company who makes them.

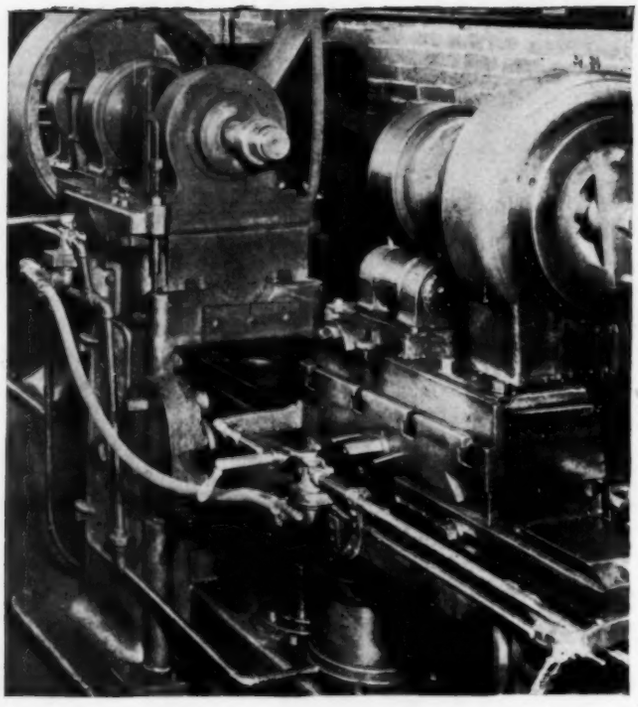
The Cleco Gruss shock absorber is chiefly used on trucks and buses, and the hemisphere in question closes the upper end of the cylinder and forms an air pocket which damps excessive movement of the springs.

The cylinders are made of seamless steel tubing $4\frac{1}{2}$ in. inside diameter with a $\frac{5}{32}$-in. wall. The piece of tubing, 17 in. long, is placed in an open-flame gas furnace, and the end to be formed is brought to a cherry red heat. It is then placed in the chuck of a specially designed machine, and the saddle of the machine is moved forward until the hot end of the tubing is telescoped over a mandrel held in the head, which is belt driven direct from a motor mounted on the wall. The entire table is then raised by means of a central ram until the inner bottom surface of the tubing is against the rapidly revolving mandrel. This contact revolves the tubing and the chuck, the downward thrust being taken by a pair of rolls under the outboard end of the chuck.

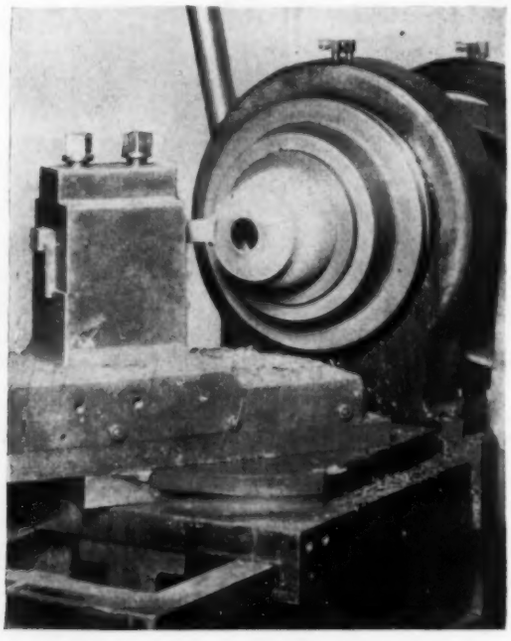
It is important that the outside of the cylinders present a uniform appearance, therefore the inside of the chuck has a shape corresponding to the spinning mandrel. The pressure tending to raise the table is maintained until the tube is expanded against the inside of the chuck.



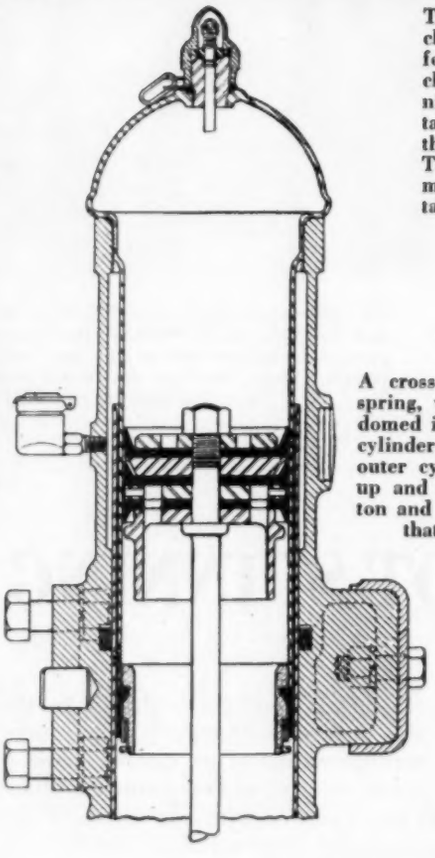
A close up of the expanding operation. No power is applied to the chuck. The downward thrust of the mandrel is taken by two rolls at the outboard end of the chuck



The expanding machine. Showing the formed mandrel, the chuck, the feed mechanism that raises the table, and the one that feeds it forward. The machine was made from a horizontal boring mill and a die sinker



The spinning operation is done on a reconstructed hand milling machine. The carriage is arranged to turn at the proper radius. The tube being heated, power feed is not necessary



A cross section of the air spring, with the mushroom-domed inner cylinder. This cylinder is telescoped in an outer cylinder which moves up and down with the piston and builds up a pressure that absorbs shock

A tell-tale visualizes the raising of the table and indicates when the operation is finished. At the point of greatest diameter, the tube is expanded to 6 inches.

The machine used for expanding purposes is a shop-built mechanism, of which a horizontal boring mill and a die-sinking machine form the nucleus. The pneumatic drive and control are standard product of the Cleveland Pneumatic Tool Company. Notwithstanding the wedding of this oddly assorted pair of old machines, the apparatus as a whole presents a workmanlike appearance.

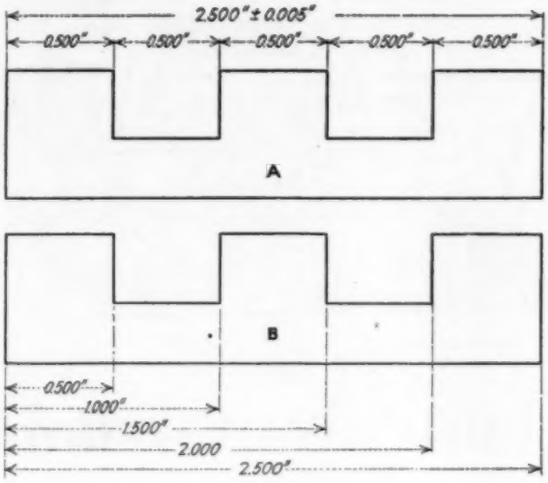
After the expanding operation the tube is placed in the self-locking chuck of the spinning machine, without reheating. The spinning tool is held in a fixture which is swung at the desired radius by means of a feed screw. This machine also has a familiar appearance, and we find that it was once a hand milling machine.

The final shaping operation is to form a boss at the top of the dome. This is done in a 300-ton hydraulic press. For this operation the tube is set over a mandrel which acts as a lower die, and the boss is formed between it and the upper die. So rapid has been the handling of the part, that the three operations of expanding, spinning and forging have only consumed four minutes, and it is not necessary to reheat the part. Two men perform all the operations.

Photographs courtesy Cleveland Pneumatic Tool Company.

Redimensioning for the Jig Borer

Discussion



George Belbes

Teletype Corporation

C. W. HINMAN and Chester B. Lord, co-authors of the article "Redimensioning for the Jig Borer," in Vol. 74, page 231, *American Machinist*, are advocating a reform in drafting technique needed by the tool designer, and die-maker, the tool-inspector, the shop inspector, and machine operator. The shortcomings of the old method are outstanding, yet it is in use in most metal-working plants. Even the engineering divisions of the U. S. Government are still adhering to orthodox methods.

The present industrial development is one of specialization; that applies to the engineer, the tool designer, and the draftsmen, as well as to the tool-maker, the mechanic, and the machine operator. An engineer who is expert in machine design is not necessarily an expert in tool design or tool making, and vice versa. It is the recognition of these facts that has led to the establishment of different departments for engineering drafting, tool designing, manufacturing, etc., in the modern plant. I believe it neither proper nor economical to allow an engineer or a machine designer to make complete detail working drawings of machine parts which he may design.

Perhaps the best way to bridge the gap between the engineer, tool designer, and die-maker is to make it the province of the drafting department to redraw and re-dimension all engineer's sketches to suit tooling and manufacturing conditions. Shifting the work to the tool designer and the shop is, surely, an expensive procedure and is often the cause of serious errors. The draftsman is better equipped and has better knowledge of mathematics than the man in the shop; he is therefore the logical one to lay out, calculate, and dimension drawings.

There is a noticeable trend towards dimensioning from a common base. This should be encouraged and adopted whenever practicable, and it is practicable in nearly all cases. It will save money, facilitate the work, and eliminate cumulative error.

Adoption of this drafting technique would be justified if it did nothing more than clarify to shop men the proper application of tolerances. For example, when a part similar to that shown at *A* in the accompanying sketch is dimensioned according to conventional practice and a tolerance of plus or minus 0.005 in. is assumed over all, many shop men would interpret the drawing as meaning that on the overall dimension the allowable tolerance is the cumulative tolerance of all sections, in this case 5x ±0.005 or ±0.025 in. Were this part dimensioned as in *B*, such troublesome questions would never arise.

J. Homewood

Instructor, Chaffey Union High School

ALTHOUGH the method of dimensioning as shown on page 231, Vol. 74, of the *American Machinist*, facilitates matters for the operator of the jig-borer, there arise further necessities which will lessen chances for error in reading the drawing. A practice of placing the dimensions as shown in Fig. 1 arrives at the same result and saves time and confusion, since it is known that the dimensions are taken from the known base-lines.

Either of the methods shown can be used when the drawing is not complicated. However, let's look to the convenience of the workman. Inasmuch as the dimensions are given from two base-lines, namely, left and top, there is a chance that the operator will select the wrong figure when selecting the corresponding dimension. The danger of selecting wrong allied figures increases with the complicacy of the drawing. Although the dimensions clearly indicate that a certain location is given definitely from the top and from the left, the human element must be taken into consideration.

As the dimensions are given in two directions, could we not establish a practice of giving the dimensions as shown in Fig. 2, wherein the figures in brackets are understood to be distances from the top base-line? This would eliminate possible reading errors and time in selection. It would save considerable strain on the operator's eyes and unnecessary lines on the drawing.

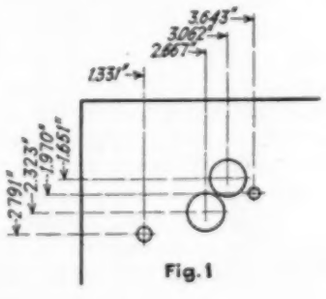


Fig. 1

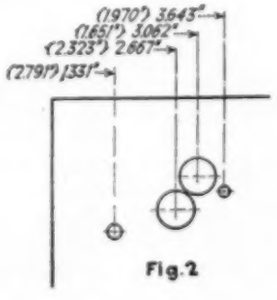
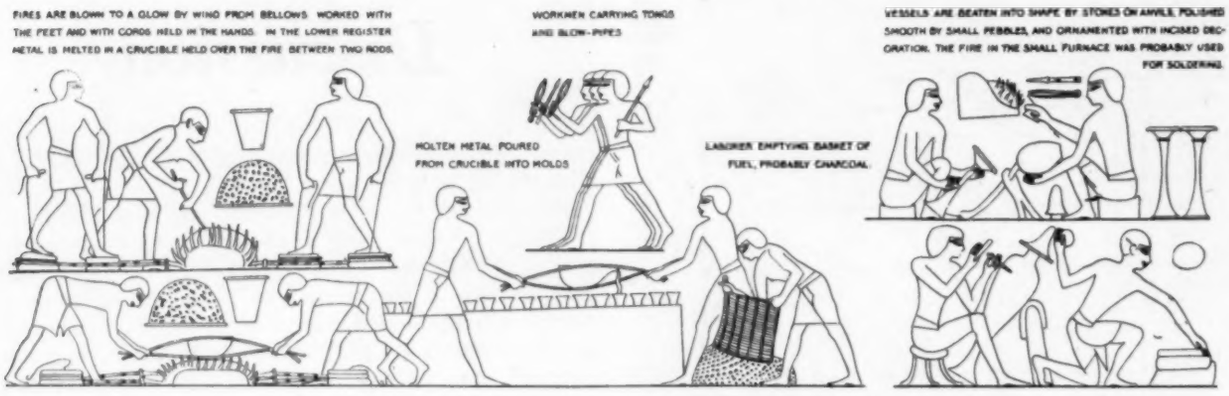


Fig. 2

"THE ANCIENT EGYPTIANS


FIRES ARE BLOWN TO A GLOW BY WIND FROM BELLOWS WORKED WITH THE FEET AND WITH CORDS HELD IN THE HANDS. IN THE LOWER REGISTER METAL IS MELTED IN A CRUCIBLE HELD OVER THE FIRE BETWEEN TWO RODS.
WORKMEN CARRYING TONGS AND BLOW-PIPES
VESSELS ARE BEATEN INTO SHAPE BY STONES ON ANVILS, POLISHED SMOOTH BY SMALL PEBBLES, AND ORNAMENTED WITH INCISED DECORATION. THE FIRE IN THE SMALL FURNACE WAS PROBABLY USED FOR SOLDERING.
MOLTEN METAL POURED FROM CRUCIBLE INTO MOLDS
LABORER EMPTYING BASKET OF FUEL, PROBABLY CHARCOAL
FROM WALL-PAINTINGS IN THE TOMB OF REKHMARA AT THEBES
DYN XVIII (1533-1450 B.C.)

Metal-working in Ancient Egypt

had

THE amount of stone-cutting done by the ancient Egyptians was prodigious. Vast quantities of granite, diorite, sandstone, and limestone were cut, the granite and diorite being particularly hard and difficult to deal with. The work included tombs and temples excavated in solid rock, quarrying and shaping of building blocks, statuary, mural pictures, and hieroglyphics, and notable for its high quality as well as its quantity.

Most writers on this subject say that the early Egyptians, before 1300 B.C., did not have iron or steel tools for cutting stone, and some offer wild speculations as to the means they employed for that purpose, including tools of hardened copper and attrition with emery. To deny the use of steel for stone-cutting by the ancient Egyptians is, to a steel metallurgist, almost like denying the cutting itself; for *hardened steel is the only substance known to man which could have served the purpose. There is no other.* The result proves the means. When one sees a granite building or monument in Egypt or elsewhere, he knows without being told that the stone in them was cut with steel tools. He does not have to see the tools. One is amazed on realizing how great had been the progress of the Egyptians in civilization before the dawn of history, or, to be explicit, before the time of Menes (3500 B.C.), of which no account exists, and but few works. For many thousand years they made great and rapid progress up from barbarism to be able to produce beautifully carved statues of hard stone and such a pile as the stepped pyramid of Sakkara, 200 ft. high. These were followed in a few centuries by the great pyramids, in some respects the greatest structures ever reared by man. That of itself points to their use of metals, and particularly of steel, as tools made of iron would have been ineffective for cutting or carving hard stone. Further, prehistoric statues show as good workmanship as those of 2,000 years later.

The ancients manifestly did not discriminate between iron and steel, and they used the name "iron" for both. The essential ingredient which iron must contain for it to be steel, in the usual sense, is carbon, which confers on the metal two most important properties: First, it lowers the fusion temperature, one per cent lowering that point 90 deg. C. or 162 deg. F.; second, it gives steel the property of being greatly hardened by heating it to bright redness and then suddenly cooling it, as by immersing it in water. It is this hardening property, when followed by suitable tempering, that makes it the one material adapted for stone-cutting tools, which for that reason should contain near one per cent of carbon.

The main reason advanced for holding that the ancient or prehistoric Egyptians did not have steel is that iron and steel articles are not found in the temples, tombs, and other edifices built by them. That is negative evidence which proves nothing. It may be explainable. For one who was of sufficient importance to have a large tomb furnished with requirements of a future existence, it may have been degrading to do any manual work, and so no provision was made therefor in his tomb. Iron, though precious, was not generally or often applied to ornaments or jewelry because it rusted easily, and also because it lacked the beauty of gold, silver, and bronze. Again, iron and steel may have been applied solely to useful purposes, for which it was indispensable, as bronze, which was cheaper, did well enough for purposes of war. Further, as has been mentioned by others, religious prejudices against iron may have been the reason why it was not placed in tombs. All known tombs were rifled by the later Egyptians, the Persians, Romans, and others who held the country. Any piece of any metal discovered by anyone in any way in the ensuing period was naturally prized and carried off. Those remaining have been mostly covered by material borne by water or wind; little, therefore, has been available for moderns. The number of tools employed in cutting stone was very great, and they must have been worn out in service; but no such worn-out tools have been found. Made of a precious metal, the reason for this is obvious. If of bronze, samples, new or worn, would surely have survived, but none are known. If of stone, they would now exist in profusion in the waste

heaps of the country; but none are found. Stones and stone implements used for abrading other stone surfaces by continued pounding or rubbing are found, but not such as could have served for cutting.

Let us follow the considerations pointing to the use of steel. To begin, it can hardly be denied that gold was the first metal to be used by man. It was by far the commonest and most abundant of the few native metals, and but little inventive skill was needed in shaping, by pounding with a stone, to some of the simpler uses. But only the larger pieces or nuggets were capable of such use, and much of the gold found by washing sand or gravel was in small pieces, or "dust." To make larger useful pieces out of dust demanded that it be melted, which naturally was done in a clay pot, or crucible; for the development of the potter's art antedated, perhaps by thousands of years, the use of metals.

The temperature required to melt and cast gold, about 1,100 deg. C., was readily attained with a charcoal fire. So the use of a refractory clay vessel for holding and melting, and so putting into a useful form a lot of precious metal grains or fragments, was obvious. The idea of melting valuable gold-dust loose in a fire would not have been given a moment's consideration. King Tutankhamun's gold sarcophagus, of a later date, to be sure, or 1350 B.C., demanded pieces or slabs of the metal weighing almost 200 lb. each. Bronze figures also called for large pieces. This melting of gold in pots constituted man's first metallurgical operation.

Next, we know that the Bronze Age preceded the use of iron by a long period, perhaps thousands of years; and it is a fair conclusion that the tin and copper of which bronze was composed were also smelted in crucibles or pots which were in current use for melting gold. It is quite certain that the first tin ore or tinstone to be noticed and worked was the oxide—the mineral cassiterite—known in Cornwall as "Streamtin," from its occurrence in loose, small pieces in the beds of rivers and other streams of water. It was found in some gold-washing operations, as in Malaya. It was heavy, and remained behind with the gold after everything else had been washed away. Why it was suspected of containing a metal, and an easily reducible one at that, is a matter for conjecture. Its acting like the metal when washed may have given the clue, or the first reduction of a metal from it may have resulted from exposure of the ore to the heat of a thick fire in which it happened to be by accident or design. In any case, purposeful efforts to produce a metal from it naturally included attempts to melt it in crucibles.

The charcoal needed to reduce the oxide of tin to the metallic state may have gotten into the pot by accident, but more likely a layer of hot coals was put on the charge in the pot to confine and so conserve the heat. When a little metallic tin was seen to be reduced by such charcoal, the rest was easy, and the proportion of charcoal required in the charges to reduce all the tin was soon determined.

The reduction of copper to the metallic state was less simple. It may have resulted from efforts to extract gold from the mineral chalcopyrite, which is a yellow

Hardened Steel"

HENRY D. HIBBARD
Consulting Metallurgist

Contrary to the opinion of Egyptologists, Mr. Hibbard believes the ancient Egyptians must have had a material harder than bronze or stone. Herewith he gives his reasons and conclusions. An article in the next number of *American Machinist* explains the Egyptologists' viewpoint

Sculpture and painting in ancient Egypt, from decorations of tombs

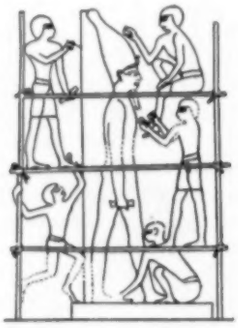
SCULPTORS CARVING A STATUE, ONE WITH AN ADZE, THE OTHER WITH MALLET AND CHISEL.

FROM A WALL-RELIEF IN THE TOMB OF TI AT SAKKARA DYN. V (ABOUT 2750–2625 B.C.)

AN OVERSEER OF SCULPTORS PAINTING A STATUETTE, AND TWO ARTISANS SEATED BEFORE WORK BENCHES, THE ONE SHAPING A CHAIR LEG WITH AN ADZE AND THE OTHER CHISELLING A HEAD.

FROM WALL-PAINTING IN THE TOMB OF HUYA AT TELL EL AMARNA. DYN. XVIII (ABOUT 1370 B.C.)

ARTISTS ON A WOODEN SCAFFOLDING SCULPTURING AND PAINTING A COLOSSAL STATUE OF A KING.



FROM WALL-PAINTING IN THE TOMB OF REKHMARA AT THEBES. DYN. XVIII (1525–1450 B.C.)

Photographs through the courtesy of the Metropolitan Museum of Art, New York City

sulphide of copper and iron. It is heavy, looks somewhat like gold, and is sometimes associated with gold in rock.

The foregoing is to show that the clay pot was in regular metallurgical use long before the production of metallic iron from its ores. Its employment in that production was, therefore, natural and obvious. Broken crucibles are found in ancient slag dumps in Egypt, though indeed of unknown antiquity. Once a metal had been obtained from its ore, many heavy minerals were tried to see what they would yield, and silver, lead, and mercury were discovered.

Now the mineral magnetite, which is magnetic oxide of iron, occurs in most, if not all, placers, that is, deposits of gold-bearing sands or gravels. While not so heavy as oxide of tin, it was next heaviest, and remained with the gold and tin ore, if any was present, when all else had been carried away by the water. This behavior suggested the existence of a metal in it.

Trials to obtain a metal from this black sand were very likely made soon after tin was produced; but while the production of tin was comparatively easy, that of iron, by such means as were then at hand presented all but insuperable difficulties. Perhaps only after trial and failure for generations, someone was lucky enough to hit upon a suitable proportion of charcoal to ore, and at the same time to raise the charge to a temperature about 1,450 deg. C., aided, it may have been, by a gale of wind to blow his fire.

Iron is reduced at low red heat from its oxide to the metallic state by contact with suitable amounts of carbon or carbonic oxide, the latter being a gas; but that is only part of the problem. To get it into a useful state, it must, after reduction, be either melted or welded into a compact mass. If it contains one per cent of combined carbon, it will melt at 1,440 deg. C.; while to weld carbonless iron, it must be heated to about 1,420 deg. C., then consolidated by hammering. These temperatures are attainable only by fires urged by a forced blast of air.

Steel Probably Preceded Welding

Now the property of welding possessed by iron may not have been known for a long time after steel had been produced by the direct process described, and even after its discovery a further long period may have elapsed before it was put to practical use in giving reduced iron a compact useful form. The difficulties of welding a spongy mass of iron, as reduced from its oxide, were so great that melting was easier even though a slightly higher temperature was needed.

Wrought iron, practically free from carbon, requires for melting a temperature of 1,540 deg. C., which was unattainable by the ancients. The chance of obtaining a useful metal was greatly enhanced by putting enough charcoal, that is, carbon, in the pot to make steel and not sponge iron. The excess of carbon was added primarily to afford a metal that they could melt. So the successful operations, meaning those in which the reduced metal was melted, were due to high carbon in the charge and, therefore, in the metal, and steel, being easier to make, was in regular production before iron. Even if iron had been first produced it would have been valueless for cutting hard stone, and no knowledge or means were at hand for making steel from it, that is, giving it the hardening property, even if that were known.

Even after steel had once been made, it could have been produced only under exceptionally favorable conditions with many more failures than successes, and with non-uniform composition and quality. It, consequently, had an intrinsic value perhaps equal to, or even greater than, that of gold. For that reason it was carefully guarded against loss, as were all metals. Only four hundred years ago, in Peru, iron was at one time more valuable than silver, with which, in lieu of iron, the conquerors shod their horses. Seven hundred years ago, Marco Polo found places in Asia where gold was worth but 5 or 6 times as much as silver, weight for weight. In ancient times, silver was more valuable than gold. The law of supply and demand determines values.

Meteoric Iron Too Soft for Cutting

All meteoric iron found by the ancients was carefully preserved and utilized; but it was too soft for cutting hard stone, and no way appears to have been known to them by which they could make it into tool-steel.

Iron ores being plentiful, trials to produce iron from ore in an open fire followed its production in the crucible in due course; but the metal obtained, if any, was different from that obtained in the crucible, and inferior for many purposes, including stone-cutting.

The crucibles for making steel were small, to favor the attainment of the high temperature required. Presumably they were relatively long and narrow so as to give the charge, when reduced, melted, and then solidified, the form of a short, thick bar. The quantity of steel produced in one charge was probably small, perhaps one or two pounds, or enough for one chisel or other tool. It was allowed to cool in the crucible, to be heated and hammered to the desired shape later. To cast it into an ingot would have been far more difficult.

Hard steel produced as described, when suitably shaped, for doing which it was heated, gave good service in many lines, but the great benefit, especially for cutting stone, came through hardening and tempering, which was discovered presumably by accident. Some one who was in a hurry had a charge of steel successfully melted and solidified in the crucible. To save time, he broke the vessel away and plunged the hot ingot into water, which made it extremely hard but too brittle for most purposes. Manifestly the hardening was due to the quick cooling, so the natural cure for brittleness was reheating. Experience taught the rest.

Being precious, steel was used sparingly, substitute means being employed whenever practicable. These included crushing or abrading by pounding with hard stone, and wearing grooves by a cord or rope with grains of quartz or emery sand intermixed, drawn along the line of the cut. The first mentioned is illustrated by the work done on the unfinished obelisk in the granite quarry at Assouan. Channels were abraded around the contour of the monolith about 30 in. wide and 8 or 10 ft. deep, manifestly by continued attrition with cobblestones or small boulders thrown down upon the bottom of the cut.

Any or all steel used by the Egyptians may, of course, have been made elsewhere and imported. If there were any smelting works in the valley of the Nile before Moses, all remains of them are now deeply covered, beyond probable discovery, by accretions deposited by the river in its overflow, and also blown on by the wind. Any steel tools which may have been lost would have been covered; and, further, would have rusted away.

Describing the building of Cheops pyramid, Herodotus, about 450 B.C., refers to the great cost of food consumed by the workmen, and the greater sum that "must have been spent on the iron with which they worked." In his time "iron" included steel. As already stated, most iron then made probably contained enough carbon to have the useful hardening property, and was, therefore, steel.

Another, and perhaps equally plausible chain of events may have led up to the production of iron and steel. Copper, as stated, may have been extracted from chalcopyrite in an endeavor to get gold. Then trials may have followed to get copper from iron pyrite, which is also a heavy, yellow, metallic mineral, and these trials may have yielded iron. Then, the resemblance of some limonite iron ores to pyrite which has been heated, exposed to air, as in roasting, may have suggested the presence of iron therein, and led to trials which resulted in the production of iron or steel from its oxide, in crucibles at first, and in the open fire later.

In the Cairo Museum, Exhibit No. 79 is a pictorial representation on a stone slab, of two men chiseling a statue of a man. Each uses a chisel about $\frac{3}{4}$ in. wide stuck in a handle, presumably of wood, from which it projects about 4 in. He strikes upon the handle with the side of a short club or billet, probably also of wood. An adjoining picture shows two men rubbing the head of a similar statue with egg-shaped objects, presumably of stone, manifestly to smooth and polish it. In the same row of pictures are two men working at what seems to be a pot-melting furnace, the fire of which they blow upon through tubes. Bellows had not then been invented.

In the tomb of King Ti at Sakkara, recently discovered, a mural picture shows two men similarly cutting a statue with chisels also set in handles on which they pound with the end of a block, also presumably of wood. All four of these chisels are about the same in size, and manifestly are of steel, as no other material in such form would do the work. Nearby, on the same wall in King Ti's tomb, is a picture of a fire, blown by four men through pipes, which heats a vessel that might be used for melting metal. The blowers might have stood for a much larger number of men actually employed; ignorance of perspective prevented showing more.

For ordinary purposes of cooking and heating organic substances, such as wax, fat, and bitumen, and perhaps even for melting gold and bronze, it would not have been necessary to blow the fire. So the pictures mentioned show operations where exceptionally high temperatures were required, as for making or melting steel. Doubtless a search would discover more pictorial evidence of similar import.

Statue Shows Marks of Tools

An unfinished colossal statue of a man about 8 ft. tall in the Cairo Museum shows plainly the individual cuts made in the red granite which composes it, in roughing it to shape. The chisel used was like a cape chisel of today, the cutting edge being about $1\frac{5}{16}$ in. wide and rounded. Chips or flakes of the stone one or two inches wide had been broken off all along the cuts which had ploughed deeply into the stone. Wooden handles for the chisels would have been too weak for this work, but handles of bronze might have served. Examination of this statue and its tool marks is enough of itself to convince one that the cutting was done with hardened steel tools.

Hieroglyphics cut on granite surfaces have plainly been chipped out and not scratched or abraded, while sharp-cornered recesses in hard rock have manifestly been achieved with tools of hardened steel.

For splitting blocks of stone, granite included, they cut tapering grooves, either intermittent or continuous, along the intended line of fracture. These grooves received dry wooden wedges tightly driven in, on which water, preferably hot, was poured, which swelled the wood and split the stone. Now, these grooves are rarely, if ever, over 3 in. deep, which indicates that only short tools were available, as deeper grooves would have been more effective. Grooves in blocks not split show that they may sometimes have failed of their purpose, presumably because they were not deep enough in proportion to the thickness of the stone.

No metal scraps or worn-out tools of any kind, gold, bronze, iron, or steel, are found in the tombs or other remains of prehistoric or ancient Egypt; only finished articles. All such scraps were evidently remelted to make new goods. It was easier to make new steel tools by melting steel scrap than to reduce and melt new metal from its ore.

Sir Henry Bessemer, in an address in England, half a century ago, expressed his belief that the ancient Egyptians had hardened steel tools for stone-cutting. So we conclude that the ancient Egyptians had steel tools for cutting stone, and the reason that no steel or other stone-cutting tools are found is that the worn-out steel tools were carefully preserved and remelted, while the reason that no worn-out stone tools are found is that none were used.

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Chromium Plated Molds

H. E. Stockfisch

Inquiries concerning the cost of chromium plating molds, raised by my article on this subject in *American Machinist*, Vol. 73, page 553, may be answered by the following data giving the approximate distribution of capital investment in equipment. This is affected to some extent by the state of the deposited plate. If products are to have a lustrous finish, buffing equipment will be required, if products are to be plated for wear or corrosion resistance, the customer usually is expected to furnish the job with the finish required, and therefore it is a problem of deposition. This list omits buffing equipment:

	Per cent of total cost
Generating equipment	35-50
Tanks	15-20
Controls (rheostats, buses, etc.)	3-5
Ventilating fans, ducts, etc.	5-10
Plumbing (water, steam, air, piping)	3-5
Boiler (depending on tanks)	5-10
Compressed-air devices	4-6
Cranes and hoist facilities	3-5
Racks, frames and clamps	5-10

Operating expenditures such as electric current, gas, fuel, water, chemicals, incidentals, labor, maintenance and the like, are controlled principally by volume of work.

EXECUTIVE FORUM

Dismissal Wage

THE HARDEST part of a works manager's job comes when he is faced with the problem of reducing his force. The first cut may not be so bad because he can then dispense with the drifters and incompetents who have been hired to meet a production peak. But when it is necessary to eliminate men who have rendered years of faithful service, his problem becomes more difficult. Howard Courtney, Works Manager of the Norwalk Loom Works, faced this situation and felt his responsibility keenly. Certain questions prompted his visit to the president's office.

"Good morning, Mr. Austin. Can you spare a few minutes?" As Austin assented, Courtney continued, "Bill Anderson, one of my lathe hands, is getting through today. We gave him notice earlier in the week. He stopped me in the shop a few minutes ago and asked how much we were going to put in his pocket besides his regular pay. I felt rather guilty when I had to refuse him anything."

"Anderson has been with the company long enough to know that we don't pay a dismissal wage to hourly workers," said Austin.

"Yes, but that doesn't convince him of the justice of it," said Courtney. "He has a cousin who worked upstairs in the drawing office until a short time ago. The cousin was given a month's pay when he was let out. Anderson believes he is entitled to at least as much and points out that he has seen several years more service than his cousin. As he puts it, he can't understand why he should be handicapped just because he is a producer and not part of the overhead."

"I hadn't thought of it in exactly that light," said Austin, "but there are several very good reasons for the distinction. A man's hourly wage is a direct charge against the product. The purpose of force reduction is to cut costs. If we pay a dismissal wage to each man we let go, we'll be defeating our own purpose."

"No more than for office workers," said Courtney. "Industry is realizing more and more its responsibility to employees. A discharged worker suffers loss of income and needs some sort of a cushion to ease him over his period of adjustment."

"In some cases, the cushion might be too soft and destroy incentive to hustle for a new job," said Austin. "Good skilled workers can usually find work without much delay. Others might find the extra pay more of a handicap than a help. It would merely postpone the time when they'd have to shift for themselves."

"A number of companies have recognized that good workers and poor ones alike face financial loss when seeking new jobs," said Courtney. "When the U. S. Rubber Company closed its Hartford and New Haven plants, it gave the old employees one week's pay for each year of service. A survey of the dismissed workers in one plant showed that their earnings for the following year fell to 40 per cent of their former pay. Even with the dismissal wage, the total income was only 84 per cent of that previously received."

"A better plan is to have wage rates high enough to enable men to save money and thus provide for their own relief when forced to seek a new job," said Austin. "A man feels a pride in knowing he has created an emergency fund of his own. This gets away from the gift or gratuity idea entirely."

"A dismissal wage is in no sense a gift," said Courtney. "A man, who has put good years of his life into company service, has it coming to him. It's fine theoretically for a workman to live on his savings but not many are able to put the idea into practice. A lot of sales pressure is put on people to 'buy now.' But when they live up to their incomes, they're called improvident."

Suggested by H. S. Deeley, Planning Engineer, John Manville Company Ltd., Asbestos, P. Q., Canada.

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What Do You Think About This Problem?

Mexican employees discharged without just cause, must be paid three months' wages. Many other countries have enacted similar but less liberal legislation. In the United States, dismissal wages are left entirely to the employers' discretion. Should a dismissal wage be paid, or should some other means be provided to take up the slack between jobs? Should hourly workers be treated the same as salaried employees? Is this a subject for legislation or one to be solved by the companies themselves?

. . . Discussion

of Executive Problems

■

Cash or Check?

I formerly worked for a large corporation which was spread over an entire state so it was necessary to operate a pay car on pay days. The men were always paid in cash until one day there was a hold-up and a young paymaster was killed, leaving a wife and several small children without support. Soon after this calamity, the company inaugurated a check system. There were some complaints at first, but soon all the men saw the justice of it and co-operated to such an extent that the check system became a complete success.

My present company paid in cash until about a year ago, when there were rumors of a hold-up, and then changed to the check system with very little difficulty. You will always find some men who will object to being paid by check, but now is the time to start the system when most men are very glad to get their salary every week whether it be in cash or check.

—J. WALTER WRIGHT, *Assistant to the President, Wilmot Fleming Iron & Steel Company.*

Ex Rights

When a man of the grade of production manager is leaving a plant, it is small business to deny him a copy of a few forms. Some firms have blank copies of ordinary forms that are available to interested employees. Such forms are of little value in themselves, and no important methods or secrets are so divulged.

At one plant where I was employed, an industrial engineering firm was retained to install their system. The engineer made no secret of his methods, claiming that all concerned should understand it. When questioned as to how his firm expected to stay in business and collect high fees, he stated that very few men would master all the details and then be able to find a client. Business firms want the reputation of the engineers as a guarantee of success in ventures of this kind.

No method has been devised to make a man leave what he has learned behind him, so he should gladly be allowed to take advantage of what little aid a few forms can give him. —L. F. SWENSON, *Industrial Engineer, Perkins Machine & Gear Company.*

Convenience or Confusion?

While there are a number of excellent reasons favoring the substitution of the metric system for the present inch measurement, the question of cost in time and money is sufficient to prohibit such a step. I had a concrete illustration of this while in the service of a British locomotive concern in the early days of the World War. This company, as a result of the German occupation of Northern France, received a large order for locomotives from the French Government, built according to their specifications and under the supervision of French inspectors. This of course called for the use of metric dimensioning on all parts. A complete set of jigs, fixtures, and gages had first to be made, a costly and slow process for mechanics unaccustomed to the new measurements. On the manufacturing end, many costly blunders were made, and during the period of conversion to the new system, work spoilage records assumed nightmare proportions.

Under modern conditions, and with improved methods, a great deal of this wholesale scrapping could be eliminated, yet I am confident that the introduction of the metric system would be more productive of confusion than convenience during the months of the transition period and therefore would be economically impractical for many of the smaller concerns.

—ROBERT S. ALEXANDER, *Universal Winding Company.*

It is unfortunate that so few engineers and shop men realize the simplicity of the metric system. If it were better understood, it would probably have a good chance for speedy adoption. But executives, especially those of the old school, dislike the thought of any radical change, and never having used the metric system, fail to see its vast saving of labor and time.

The fact that there is no relation between the present measures of length and weight ought to convince even the most stubborn skeptic that a change is needed. Protests against the adoption of the meter are generally centered around the expenditure involved in its introduction. It is said to cost more than the gain would justify, that the enormous losses of such a change would upset industry and curtail production. It must be remembered that no one has ever proposed the adoption of the metric system overnight. The change should be gradual, covering several years.

Any unbiased student of the two systems will admit that inches, feet, yards, rods, fathoms along with pounds, ounces, and grains are obsolete and as such should be classified with antiquated machinery and methods. The argument has also been used that even in countries where the system is in general use the dimensions of threads and shafting are still commonly in inches; but these are rapidly being displaced by the metric standard. If it were possible to calculate the daily waste of time and energy in the average factory and more especially in the binary fractions, the men in power would soon have a drafting and designing departments in manipulating change of mind. DAVID GRIDLEY.

One Big Family

Because of cheaper transport, workers now live further from their work, and it is increasingly difficult to persuade them to join in social activities at the plant. Sports are useful to the younger members of the staff and do foster company spirit. Canteens are appreciated by all, especially if any form of amusement is provided for the rest hour, but it is quite another matter when the home hours are invaded.

Modern transport facilities have another bearing on

this matter. Workers change their employment more often than formerly, and this must not be hindered, as the constant stream of new blood with fresh ideas is necessary to every trade. Social activities hinder this movement.

—M. P. DALTON,
London, England.

There is no doubt that friendly relations among the employees of an organization are desirable. There is no greater morale builder than a frank feeling of friendliness that comes through close association.

Like most worth while things, it is something which cannot be created artificially, nor can it be inspired by official action. The impulse must come from the employees themselves. If an ambitious personnel director gets the idea that he can bring all this about by welfare plans, it's ten to one it will fail—instead of producing good will it will most likely have the opposite effect.

The only thing that management can do to foster this spirit is to imitate the politician and keep its ear to the ground. If it sees signs of a budding activity springing spontaneously from the men themselves, it can lend encouragement—quietly and preferably indirectly. It must never suggest paternalism. The work should be done through the natural leaders of the men, and never through a personnel director.

—HARVEY S. HINCHMAN.

Home Work

Very few men have the happy knack of diverting their thoughts from affairs about them and concentrating on some important problem. So for most that homework in some form seems essential to the man whose heart is in his job. How far that homework is carried should depend on immediate necessity; if the necessity becomes a regular nightly feature, it clearly shows that something is wrong with the organization. No sane engineer consistently overloads a machine. Why should he consistently overtax his greatest asset, his health? From the man's point of view it is not worth it, for he is only indispensable to a job while he is actually filling it; the day he retires is the day a substitute comes in.

—LEONARD COOMBES,
Warwicks Time Stamp Company,
London, England.

Brain Fag

The office where I have seen the most work produced per day was located across the street from a park and was equipped with air conditioning units. The chief engineer was a crank on noise and had it reduced to a minimum. No telephones were in the room, all conversations taking place in sound-proof booths; the typewriters were noiseless, and loud talkers quickly quieted down. The lighting conditions were as good as could be had at that time. It was surprising to see how easily a man could tackle a difficult problem, concentrate on it, work it out without a break for hours at a time, and still leave at night with a clear head and a feeling of good fellowship.

Unfortunately, the same conditions do not exist in many factories, and often even after a relatively short effort, the brain becomes sluggish and refuses to work clearly. Then if the chief is reasonable, any worker, be he draftsman, engineer or clerk, should have the privilege of a period of rest. Some of us will take a walk through the shop and be refreshed, others will have a short smoke. It has worked well in places to open the windows and let everybody rest for ten minutes in the middle of the forenoon and afternoon. On close production lines, operators, especially women, cannot work at sustained speed without definite rest periods; most progressive firms have recognized this fact and have relief operators filling on a definite time schedule.

—B. E. RENAUD.

Rest periods are essential to the man performing hard physical labor. On the other hand, rest periods would prove detrimental to the man doing mental work because they would take his mind from his work, and he would have to begin all over again. The man who has learned to concentrate does not even think of rest until he has completed his task. He is so interested in his work that he does not want to be disturbed.

When a man doing mental work stops to rest, it shows that he had not learned to concentrate, or there is something wrong with his physical condition. There are a number of things that can prevent a man from concentrating, such as insufficient sleep, overeating, uncomfortable surroundings, or physical pain. The man who regulates his sleep, uses discretion in selecting his food, and above all does not overeat is far better equipped for mental work than the man who disregards the laws of nature and then attempts to make reparation through rest periods.

—W. J. OWENS, *Foreman,*
Newport Rolling Mill Company.

Misguided Loyalty?

Generally speaking, loyalty to the firm should be the basic consideration of all employees, regardless of whether they are works managers or machine helpers. There is, however, an exception in the case cited of President Wharton and his assistant works manager. Since the president was fully aware of the drop in the efficiency of the works manager, he should have discussed this with him rather than with his assistant. In handling the situation as he did, the president was tearing down the loyalty of his organization when he should have built it up by following established lines of authority and responsibility.

The ninth law of management decrees that the lines of responsibility and authority shall be clearly defined, and once defined, should be closely followed.

—O. M. DUNTON, *Industrial Engineer,*
American Seating Company.

The best thing to do is to grab a piece of paper, scribble a resignation on it, and then go ahead and tell the big boss all you know. Not all you think, but all you know. Of course, if you think your immediate superior is wrong, you ought to hunt another job and get out without any fuss at all. Holding on in hopes he will be found out is too slow. I tried it once, but the other man was not found out for five or six years.

—E. H. FISH.

THE SECOND 3-M CONGRESS

Management
Maintenance
Materials Handling

A resumé of the key ideas in the outstanding papers at the National Industrial Congress in Cleveland, April 13-17

ECONOMIES achieved through "Ferrous Scrap Handling and Salvaging in the Automotive Industry," described by R. R. Rees, Manager of the Packard Motor Company, Detroit plant, justified the attention paid to this phase of manufacturing. His paper was presented at the first session, that on Scrap Handling, of the Second National Industrial Congress, now being held in Cleveland. Packard, noticing inefficiency in scrap handling, formed a salvage division, which checked up on existing scrap, its location, handling, and disposal. Immediate results were the formation of scrap baling and briquetting units and retooling in certain operations. One retooling was in the formation of the rear body panel, now made of one piece instead of three, with consequent savings.

Scrap handling had been largely a hand and buggy operation because of low ceilings. Sheet steel scrap is now collected by hand buggy and dropped into a feed hopper leading to the baling press. Scrap, instead of being sold in bulk to dealers, is baled and sold to the mills at a 60 per cent increase in price. During 1929, for example, 9,875 tons of metal scrap were baled, representing a 150 per cent net return on the investment, as well as lessening scrap floorspace.

Cast iron borings and turnings are briquetted. Spouts and chutes carry them to drag cable conveyors at the rear of the machine line, leading to a vertical chute serving all five floors of the building where most cast iron work is concentrated. Another drag cable conveyor carries the scrap from the chute bottom to a vertical bucket elevator, which in turn places it in the storage bin over the briquetting machine. Some 2,414 tons of cast iron briquettes were returned to the foundry in 1929, representing a net return of 85 per cent on investment. The Wilson Foundry installation mentioned in this paper, was described on page 245, Vol. 73, of *American Machinist*.

Steel turnings and borings were next briquetted. These had formerly been collected by hand buggy and sold to a local scrap dealer. Two major problems were oil content and volume of turnings. The disposal plant now contains an oil extractor, a chip crusher, and a briquetting machine on its various floors, chips being taken from machines by hand buggy, then dumped into conveyors which deliver them to the disposal plant. Various kinds of steel, unbriquettable alone, are mixed to permit this treatment. Oil reclaimed amounts to 150,000 gal. per year, a return of 18 per cent on the investment; 2,700 tons of steel chips are reclaimed per month, or 10,800 per year, a return of 42 per cent, on the investment, or with oil reclaimed, a net return of 60 per cent. But this is by no means all, for carpet, cotton, canvas, leather clipping, upholstery scrap, non-ferrous metal, waste paper, and dozens of other reclaimed items, including burning of wood refuse under the steam boilers, gives an annual return running into six figures and saves 13,300 tons of coal and 316,372 ft. of lumber.

The experience of the Baldwin-Southwark Corporation, as described in A. K. Nowak's paper, "Briquetting of Cast Iron Borings and Steel Turnings" at the same session, is somewhat similar. Mr. Nowak explains the reasons for briquetting in preference to other, older methods of chip disposal by showing the difficulties and low savings achieved by these methods. He explained the Timken and Deere methods of cleaning steel turnings, which differ in that the Timken method subjects the oil-covered chips to hot water jets in an enclosed chamber, the oil and water being separated later, while the Deere method, also used by Packard, first crushes the chips in a ball mill, then submits them to the action of a centrifuge. The briquetting machine developed by Baldwin-Southwark produces briquettes from either process, 7 in. in diameter by 3½ in. high, with density from 65 to 70 per cent of that of the solid steel. Bulk, as compared with loose turnings, is reduced 12 to 1. Briquettes are produced at a rate of six a minute, and can be used in electric and open-hearth furnaces as charging scrap. Savings realized amount to some $3.50 a net ton. Investment for one machine amounts to $70,000, annual output being 13,500 tons under ordinary operating conditions, giving a 67 per cent return on investment. Savings by briquetting cast iron borings are still more pronounced, averaging around $10 a ton.

C. H. McKnight, Supervisor of Inventory Control of the General Electric Co., spoke on "Segregation and Control of Waste," at the Waste Elimination session. His paper was couched in the form of a narative of the findings and remedies of a cost man placed in charge of a salvage department. He began by gaining co-operation of shop foremen in the handling and segregation of various types of scrap, partly by educational means,

partly by providing adequate, attractive scrap containers and gaining the foremen's assistance in seeing that they were used for the proper kinds. Segregated scrap was naturally salable or usable at much better prices than the former conglomerate scrap. Then figures were prepared showing net material losses on various jobs going through the plant, with the result that designers were more careful, shopmen performed little kinks to lessen waste and need for excessive stock removal, and similar things occurred to improve waste control and segregation all along the line. This is in direct contrast to the usual haphazard salvage department where no effort is made to co-operate with the shop, or too much effort is made, with the result that salvage becomes "everybody's job, which always means nobody's job."

Describing "Monorail Handling of Materials," C. W. Preston of the Majestic Household Utilities Corporation, listed four primary factors favorable toward the overhead monorail system for refrigerator construction, adopted by the Chicago plant of Majestic. These four are: little maintenance required, flexibility, simple methods of propulsion, and low cost of installation for area covered. The conveyor as constructed uses special dollies and grabs, chain boosters, air-operated drop sections, and many gravity sections. Storage track sections and side tracks for imperfect units are used, and all testing is done also from the monorail.

"Production Management Applied to the Drafting Department," presented at the Drafting Room Management session by William J. Kunz, Manager of Drafting and Engineering Production of the Combustion Engineering Company, aims to bring out some of the more important factors in the management of the drafting department of his company. The output of the drafting department was in excess of 10,000 drawings in 1928 and 12,000 in 1929, varying from 1 to 10 sq.ft. in area. Drafting room personnel may be as high as 280 men. The drafting department is divided into four divisions, known as the boiler, stoker, pulverized fuel and special divisions, each subdivided into squads working on specific types of equipment. Two classes of design are established, the individual or specific equipment class, in which more or less "standard drawings" may be used over and over again; and the second class, composed of a combination of any or all of these products as contract requirements may demand, in which the possibility of using standard drawings is remote. The special drafting division is composed of two squads, the machine-design squad designing parts for pulverized fuel installations, and the standards squad, a coordinating unit between all other squads, confining its activities to standardization and standards establishment. A special log sheet records the name of each man, together with the work he has on hand, the time it will require, and other pertinent data. This shows possible departmental unbalance, which would necessitate overtime work by some squads and idling by others. Assignment of new work is made to the squads with least to do, or men are transferred to the overloaded squad. Control of costs is expedited by having each man fill out a detailed time card, which in turn is used to arrive at cost per sq.ft. of drawing, analysis of cost per job, and similar data. It is possible to determine also whether or not costs are running over estimate. Other records show detailed data essential to accurate costing and drafting room control.

"Improving Drafting Management," by F. D. Newbury, General Manager of Machinery Engineering of Westinghouse, presents a plan or drafting room organization similar to that of the Glenn L. Martin Company (A.M., Vol. 73, page 843). Adoption of these methods by Westinghouse has cut drafting costs in half, while average salary rates have been increased, design quality has been improved, and drafting accuracy has been maintained. This has not occurred only in one department, but in three, employing some 570 men. Much of the work in these departments is special, although standardized parts are used wherever possible. Some 30 per cent of engineers' time and 20 per cent of draftsmen's time is required for development work, a problem particularly difficult if departments are not carefully organized. The plan utilizes division of the departments into complete units, called divisions, of 15 to 20 men, these being subdivided into squads of four or five each. A production supervisor, who has no responsibility for drafting management, controls the flow of work through the department. Practically all checking has been eliminated by having detail draftsmen check their own work, a procedure which has not caused errors to increase, since there is no division of responsibility for them. A careful plan of maintaining cost records and flow of production has been worked out and is described. Salary incentives are used in so far as practicable.

"Synchronization of Production Control and Conveyorization," by E. M. Olin, Works Manager of the Mansfield (Ohio) Westinghouse Works, was presented at the Conveyor Handling session. Coordination of the various elements of production, so that finished parts, subassemblies, and other materials meet on assembly lines when needed, has proved to be a large element in cost saving in the production of electrical and heating devices at the Mansfield plant. The plant, partially conveyorized, utilizes the same conveyors for handling several different units at different times. A graphic control plan is used for each conveyor, from which a plan is made of each component part back through the finishing department, the fabricating department, etc., to the raw material requirements. Every part is checked monthly and each day's performance is indicated on the feeder and assembly charts. Such a definite routing plan requires less supervision, tending to raise the function of the foremen, who have become very active in cost reduction work. With the conveyor plan, stock stocking of parts is reduced to as near zero as possible. Inventories of raw materials for work in process have been reduced 25 per cent. Sales are forecast four months in advance, raw materials being provided against that forecast and production being started promptly when the work control schedule is received. Graphic load charts are built up for the entire schedule for all types of a product, covering the four-week assembly period. Colors are used to show performance compared with the load on the system of charts.

H. C. Rundle, of the General Electric Company, presented "Material Handling in the Schenectady Plant of the General Electric Company," which was essentially a discussion of the "Interurban Conveyor" described elsewhere in this number. R. F. Emerson, also of General Electric, presented "Remote Controlled A-C Haulage at the Plant of the Trinity Portland Cement Company, Dallas, Texas," which explains the system of operation of a railroad transporting limestone from quarry to crusher house without crews. One control desk is used, though the system is a full mile in length. Flexibility is provided in that cars may be added to or removed from the system without alteration of the control system. This paper was presented at the Outdoor Handling Session.

TIME-TRIED JIG CLAMPS

W. H. MALLIET
Supervisor of Design and Development, Royal Typewriter Company

The innumerable devices for holding work in fixtures follow a few basic principles. In this article, the author reviews these principles and exemplifies them by successful applications

THERE has been no great advance in the design of drill jig clamping and retaining devices in the last twenty years or so. A decade ago several large concerns experimented with pneumatic work-holding devices for milling fixtures and drill jigs. Because of the need of air compressors and a large amount of piping, few concerns who tried it out adopted air to reduce the labor cost of securing parts in manufacturing tools of this type. One of the chief causes why this medium has not been utilized more extensively is its likelihood to fail at critical times. When this failure occurs, the pieces fly off, endangering the operators. Nevertheless air controlled chucks are on the market for turret lathes and screw machines. The compression of heavy oils or waxes is much safer and cheaper than air as a multiple clamping means for milling fixtures.

The younger generation of designers copy and apply mechanical contrivances for rapidity and minimum cost in loading that the old-time jig and fixture designers worked out. One continuous movement to locate and clamp a piece of irregular shape was the aim of these designers. Sometimes the nature of the pieces to be drilled facilitates the use of a top cover. In closing and binding this cover, the part may also be pushed into position and securely retained or made to withstand drill pressure by the additional quick twist of a screw. Let us examine the principle of an ingenious and quick-loading jig with such a cover. A jig designed along these principles (Fig. 1) has been in use by a large concern for nearly twenty years. There has been very little up-keep needed, considering the hundreds of thousands of parts drilled in this jig. The part or work is shown in heavy dotted lines. Four holes are drilled, and the pivot hole of the part is drilled on one side and reamed from the other. The part is placed in the jig against the locating clamp, *A*. This clamp is retarded in its movement by the pin *B* driven in the jig body. By swinging over the cover and hooking latch *C* under the pin in the clamp *A*, the part to be drilled is pushed back against the fixed angle stop *D* which is secured to the cover. It is necessary next to bind the work by a twist of the screw *E* in rocker clamp swivel *F*. This gives a double bind with the rocker clamp *G* as well as a bind on the screw *E*.

Fig. 2 shows the design of the jig with the same cover application but for a single bind down with the hardened head of the screw *H*. The thumb-nut on the swinging screw *K* is substituted for the latch *C* as used in

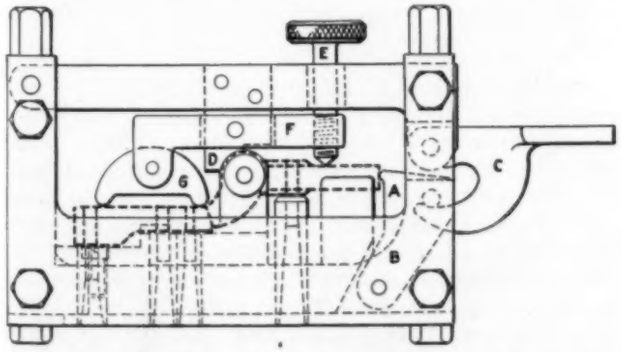


Fig. 1—The locking latch serves also to locate the work; a self-equalizing clamp provides uniform retainment

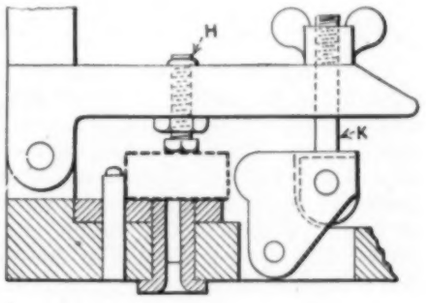
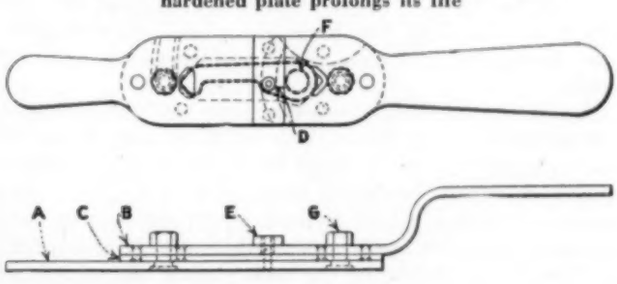


Fig. 2—A variation of the box jig shown in Fig. 1; here a single adjustable screw clamp is employed

Fig. 3—This leaf jig is light and easy to make; a hardened plate prolongs its life



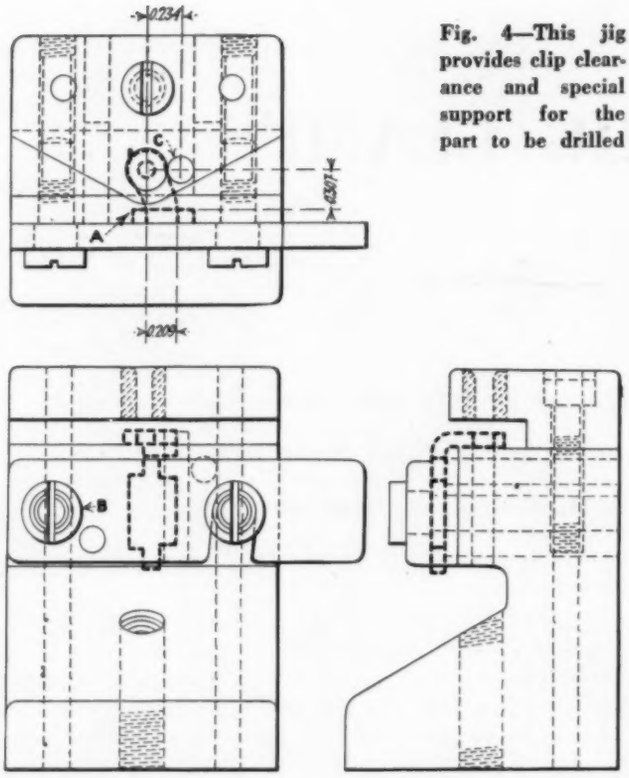


Fig. 4—This jig provides clip clearance and special support for the part to be drilled

Fig. 1. The work to be drilled is pushed against a hardened pin for its end stop.

Fig. 3 illustrates an old-time drilling and reaming leaf jig which is cheap, convenient, and readily handled. This type of jig may be used for drilling several small holes in flat sheet metal parts up to $\frac{1}{8}$ in. thickness. The cover *A* and the top plate *B* are generally made of $\frac{1}{8}$-in. machine steel, pack hardened for wear. *C* is a spacing and part locating plate of machine steel, also pack hardened and riveted to the top plate *B*. This plate is machined out to locate the part to be drilled and reamed. It should be about 0.005 in. thicker than the work. It may be noticed that the drill bushing *D* is a drive fit in the top plate.

The purpose of the hardened plate *E* is to protect and provide a cheap replaceable part for the drill to strike when the operator misses inserting the drill into the bushing. This often happens when attention is diverted from the work. In cheaper types of jigs, where this plate is not provided, it is not uncommon to see the surface around the bushing circled with small holes and the bushing nearly cut out of its bearing. *F* shows the hole to be reamed.

In operation, the leaf jig is turned over and the top plate held by the handle in the left hand. The cover then is swung on the stud *G* until the locating plate *B* is exposed enough to allow the placing of the work in position in the locating plate opening. After closing the cover, the work may be drilled.

Fig. 4 shows a standard drill block for a bent or formed sheet-metal part. This style of a jig is secured to the center of the drill press table by means of a screw in the tapped hole in the bottom of the jig body; it is necessary to drill a $\frac{3}{8}$-in. hole through the drill-press table for this screw. *A* is a hardened form plate which locates the part in a vertical slot. It is secured to the jig body by dowels and the shoulder screws *B*. The hardened pin *C* is used to take the thrust of the part caused by rotation of the drill. It may be noticed that the jig body is planed out on an angle so that the drill chips will fall to the table after passing through the hole beneath the part.

NEW BOOKS

LOEWE-DENKSCHRIFT (LOEWE MEMOIR)—*212 pages, 8 x 11 in., profusely illustrated, cloth board covers. Published in the German language by the VDI-Verlag G.m.b.H., Berlin N W 7. Price RM 15.*

Those interested in the operation of manufacturing plants or in the history of the design of machine tools, will find this commendable jubilee volume of considerable interest. The first part of the book, written by Herr Prof. Dr.-Ing.E,h,C. Matschoss, Director of the Verein Deutscher Ingenieure, deals with the history of the firm of Ludwig Loewe & Co., Berlin, and its personnel, including biographical sketches of the founders of the firm and a description of its organization. The description of how the company began with the interchangeable manufacture of sewing machines, may be of particular interest to many. The activities of the company are traced showing how they began the manufacture of arms, and finally entered into the manufacture of machine tools.

Various products that the company has manufactured are set forth and described in detail in the second part of the volume, written by Herr Prof. Dr.-Ing. G. Schlesinger. Factory production methods, cost methods, personnel relationship and welfare work, engineering and research activities, are all described in considerable detail.

The closing chapter of the book gives a hint of a thorough research work being undertaken by this company in their study of the action of cutters and loads imposed on the machine-tool elements. The volume is well illustrated with a total of 165 photographs and line drawings.

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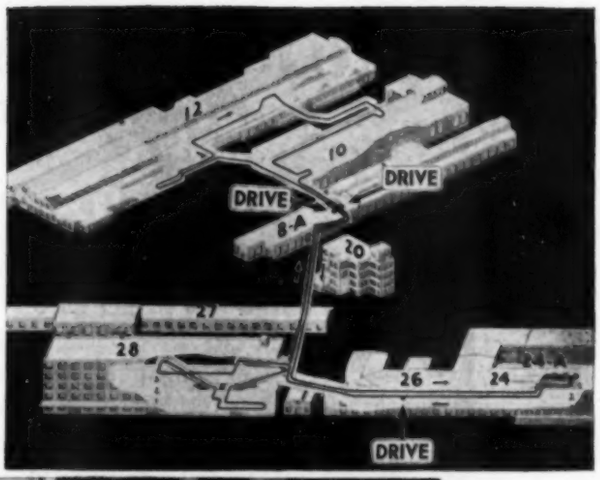
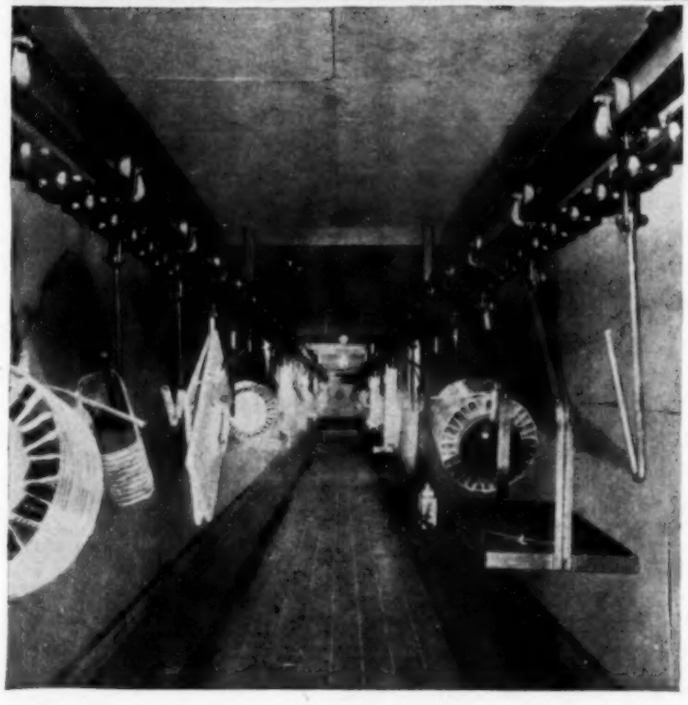
DAILY METAL TRADE STANDARD STEEL PRICE EXTRAS (SECOND EDITION)—*Edited by Walter Doxsey, Editor "Daily Metal Trade." 93 pages, 5¼x7½ in. Indexed. Paper covers. Published by the Penton Publishing Company, Cleveland, Ohio. Price $1.00.*

This is a revision and enlargement of the first edition, containing the standard differentials used generally by leading producers of iron and steel in pricing mill products. The date of latest revision of the differentials is given in each case. The listing includes chemical and physical specifications, semi-finished steel, railroad axles, hot-rolled flats, bars and small shapes, rail steel products, spring steel, tires concrete reinforcing, cold-finished shafting, plates, structural shapes, wire, nails, cold-rolled strip, S.A.E. steel, alloy steels, sheets, tin plate, seamless tubing, steel pipe, cut-length pipe, couplings, rivets, nuts, bolts, spiegeleisen, and boiler tubing. The pamphlet size and flexible covers make the book easy to carry.

INTERURBAN CONVEYOR



► Refrigerator parts require careful handling. By installing an inter-departmental, or "interurban," conveyor in the refrigerator department at the Schenectady Works, General Electric has lessened congestion, stock uncertainty, and reduced spoilage costs 90 per cent. It has released 624 hours of porter labor weekly, 140 trailers, two tractors, and an electric lift truck for work in other departments. The conveyor is used exclusively for the handling of materials from manufacturing to assembly departments; 12 buildings, an area of 435,000 sq.ft. spreading over ten acres of ground area, are served



▲ Features of the installation are the three widely separated automatically synchronized caterpillar drives, each operated by 5-hp. constant-speed motor through a variable speed reducer, which permits varying conveyor speed from 12 to 36 f.p.m. All motors are connected on one line so that voltage variations affect all equally. The drives float in a structural frame on ball bearings, with a spring cushion. If for any reason, one drive should change speed, it will quickly turn an adjustment shaft, and thus correct itself. A limit switch, placed behind the frame, is actuated by the frame in case of sudden overload of one motor, and shear pins in the sprockets provide additional protection

◄ Approximately fifty different types of parts are handled by the conveyor, ranging in size from a small wood screw to a complete compressor unit and varying in weight from an ounce to 75 lb. On the present production schedule, the chain is traveling at a speed of 26.6 ft. per min., completing one cycle in 138 min., and carrying approximately 85,000 pieces per day, about 85 tons of material. A dustproof, waterproof, heated enclosure surrounds the conveyor between departments, proper clearances and spacing of hooks is maintained, and compressor case hooks are rubber covered. Elaborate precautions provide safety

The Foreman's Round Table

SHARE AND SHARE ALIKE

ED GRAHAM was sitting on the railing in front of the office building, reading the evening paper and waiting for his friend Al who had stopped at Williams' office. As Al came out, Ed greeted him, "Say, Al, did you see about this guy that got a million and a half bonus for a year?"

"Yes. The old man and Williams were discussing it."

"What did they say, anything interesting? I could use a bonus myself, even if it were not quite a million. Tell me, Al, how can a guy earn a bonus of a million dollars?"

"He can't. The old man says that no one, no matter how big he is, can earn a bonus larger than his salary. If he gets one over that, either his salary is too small, or he is being given something. No one man should get as much as all the stockholders put together."

"If you get the chance, Al, tell the old man one hundred per cent will satisfy me. Maybe less. They didn't say anything about giving us foremen a bonus did they?"

"No, they only talked about those they were not going to give. Williams says the whole bonus and incentive business is overdone; that the more we give away the more is expected; and that the returns from it are constantly diminishing. He claims executives are liberal because it is other people's money they are spending. He advocates doing away with piece work, attendance bonuses, and every other kind, and running the shop as a straight business proposition; share and share alike."

"That don't sound like Williams, Al. I thought he always wanted the men to be treated liberally. What becomes of his capital and labor equality that he used to spout about?"

"That's the gist of his argument. At one time capital oppressed labor and gave it no more compensation than it could help. Now we are spending so much on coddling labor that capital is not getting a fair return on its money. That is, over a term of years."

"What does Williams want to do, go back to the first condition? They must have given him some stock when they promoted him."

"Nix, Ed. Williams doesn't get big head, and he doesn't forget the men. What he proposes is to give stockholders and men a common interest, and pay them alike."

"How do you mean pay them alike? A man don't invest anything."

"He doesn't? Seems to me I have heard you, and a lot of other people, spouting about capital investing its money and labor investing its time. Williams says that is true, and that to pay both alike would give the man an equal interest and do away with the ballyhoo about the inequality between the two."

"Do you mean by giving the men stock?"

"No, stupid! I mean paying the man the same dividend you pay a stockholder, and nothing more. If a stockholder invests a thousand dollars in cash he gets a dividend of six per cent. Maybe eight. If a man invests a thousand dollars worth of time, he would get the same rate of dividend, if, and when, the stockholder gets his. That method would take care of any difference in pay, and any difference in hours worked. There could be no hiding of profits, nor any melons cut that the men who helped grow it would not participate in. It looks to me as though it was the only method fair to both."

"But suppose, Al, a man quit after working nine months. What then?"

"Treat him like a stockholder. If he sells his stock. does he get a dividend?"

Is the incentive and welfare feature of management overdone? Is an equal dividend fair to both?

Suggested by S. A. Knight, Tuz Khurmatu, Irak

▸ ▸ ▸ Discussion of Former Topics

Something for Nothing

As Al says, there are few manufacturers that can step up their production to any extent. There is also a big difference in increase of efficiency in stepping down from ten to eight hours compared with stepping down from eight to seven. If, on the other hand, we keep our eight hours and have no Saturday work I don't believe that "No Saturday" would increase production during the rest of the week, it may even make "Blue Monday" still bluer. Therefore we pay either by having our weekly wages reduced or we pay because the cost of manufacture will be increased.

The only question to answer, in my opinion, is whether it is an economic necessity to work shorter hours and give employment to a greater number of people regardless of cost to the individual. Even at that the benefit will not be as great as anticipated. —J. C. P. Bode.

Wide Open

It is disconcerting to a workman to look up from his work and to find that the "boss" is looking directly at him. The foreman may just be looking into space, but the workman has the impression that he is being watched. When a man feels that he is being watched, he is distracted from his work. Such momentary distractions lead to the spoiling of work and to accidents. If a method does away with this it is certainly commendable.

From the foreman's view-point, the office behind the workmen is practical. From his vantage point, in the rear, the foreman can watch the progress of work throughout his department. Being able to watch the functioning of a department without having to leave his desk will enable the foreman to do more of the executive work for which he is hired. The big advantage of the idea seems to be that it permits the foreman to work efficiently without having to run all over the shop to keep informed.

I do not think that an open office makes for more efficient work. The industrial psychologist tells us that no executive can do his best work in a noisy place. In addition to this fact, working under noisy conditions increases the strain on a man's nervous system. It seems to me that there is enough wear and tear on a foreman's nerves without adding the additional strain of an office that is as noisy as the plant. —W. G. Bartholomay, II.

The Tower of Babble

Segregating nationalities creates rivalry. To have the different nationalities sorted out and placed in various parts of the shop is to ask for trouble. There would be the question of which section of the shop, and incidentally which nationality, produced most. Friendly rivalry at first no doubt, but it might lead to something more. The men would have the opportunity of discussing all the slight grievances they held against their fellow workmen of another race. Also, they would not have the facility of conversing with men who have a different viewpoint on life and living.

Having men of different nationality working alongside each other must cause a friendly disposition. It is impossible for them to hold a grievance, when they are constantly coming in contact with each other.

—R. H. Jackson, *Barrow, Lancashire, England.*

The Cost of Quality

Discretion must be used in "calling down" anyone for work being too good. Before blaming anyone, the thing to do is to review the specifications and limits given with the order. If no special instructions were given, the makers would naturally play safe and put in only one quality of work, the best. Every works having an order to supply parts for another company always likes to send out irreproachable work. The superintendent, foreman, and inspection department, as well as the machinist, would instinctively do their part in this. The floor inspector would be very careful. He would know that the chief inspector would instruct the one doing the final inspection to "check and double check," as the parts would have to pass the inspection department of the purchaser. Well! It is not exactly setting a thief to catch a thief, but all who are familiar with the trade know how one inspection department loves to catch the other one napping. —Alfred Layzell.

Whistlin' Willie

A shop should not be conducted like a morgue, and an occasional softly whistled or hummed tune should not be considered as justification for the wrath of the powers that be, but a chronic noise maker is a pest always. A noise has been defined as a disturbing or irritating sound. Nearly all sounds of an unexpected, unnecessary, or unusual nature will fall into this classification, since they are disturbing and distracting to anyone within earshot. Frequent repetition of otherwise unobtrusive sounds will often create objectionable irritation.

If the noise is of vocal origin it frequently indicates lack of attention to any profitable activity on the part of its producer. Also, since music creates a more or less definite reaction in most people, it is very likely to set up thoughts or responses in the minds of most of those within hearing distance varying from irritation to co-operation.

If the noise is the result of improper handling of gear-shifts, slipping belts, loose bearings or the like, a still

more positive indication of inefficiency and waste is given. Such careless handling of equipment means either poorly trained or careless workers, or incorrectly adjusted and maintained machines, all of which represents direct waste and calls for immediate action on the part of those responsible for the condition.

—W. B. LINCOLN, JR., *Chief Engineer, W. J. Savage Company.*

The Exception to the Rule

Piece prices properly set should not be changed when equipment, methods of processing, materials, and general business conditions continue practically the same as at the time the job was studied. Proper piece price setting is not merely timing operations and striking a price. The first move is an analysis to determine whether or not operations can be combined, cut down, or eliminated.

After the plant and products have been thoroughly gone over and all major and quickly applied savings made, the individual departments should be surveyed as to their personnel, arrangement, and condition of processing equipment. When the methods department, the foreman, and the machine operator feel that the processing method is correct and the equipment is in economical operating condition; time studies should be made. From these, rates would be set, which should continue indefinitely only subject to change when either equipment or methods of processing are changed.

The earning power of men cannot be taken care of or equalized without taking directly from the high earner to give to the poorer producer. A man's earning power is directly proportional to the profit the company can make on his production. Any other factor which carries much weight in his rating is unfair to both the man and the company. With rates set so that the average man can secure a fair return for his efforts and the company a fair profit on this average man's production, we have ideal operating conditions. Each worker should get out of his work, earnings in proportion to the skill he puts into it. —E. E. GAGNON, *Mechanical Superintendent, Raybestos-Manhattan.*

Trying His Wings

At the least, it is an unwise purchasing policy to advise a man to go into business with the understanding that you will give him some work.

In the first place, there is normally an excess of productive capacity in most lines. Why, in all fairness to the firms who have done satisfactory work for you in the past, should you encourage some one else to increase their competition, and why should you turn over work to an untried source?

In the second place, how, in fairness to your own company, can you undertake to deliver work to a still nonexistent shop in preference to those who may have served you well in the past?

If it is the ambition of most men to start a small shop of their own, it is likewise the ambition of most small shop owners to secure a good permanent position in some larger organization.

Once having advised a man to start a business for himself, one's responsibility is entirely dependent on the actual arrangements.

—W. A. WALTER, *Purchasing Agent, Pneumatic Scale Corporation.*

Age and Its Compensations

It would seem truer to the facts to speak of "Age and its Handicaps." Rationally regarded, experience should count well in the reckoning. Other things being equal, the married man, and particularly the father, can be expected to possess a more responsible view of things than a single man. In fact, many of the most reliable men are those in the forties.

The gage of worth should be that of the value received for the value given. Apply that test; and it will be seen that the father machinist is frequently well ahead of his son machinist as regards the quality of his output, also its rate. When it comes to an executive position, the disparity is all the greater in favor of the veteran. The man well over forty is usually a better sticker, more reliable, and turns out as much work and better work than does his colleague in the prime of his twenty-seven years.

Age does not want compensations. It only asks for a fair deal. It will gladly submit its case to the impartial verdict of results. Many of the most progressive engineers, the keenest and ablest workers, are men over, rather than under, the much-vaunted age limit. -The facts only need to be stated; and the absurdity is apparent. The thing would be laughable if it were not in many instances tragic.

—W. R. NEEDHAM, *Stafford, England.*

The Cost of Quality

When a new machine is designed, minor details are apt to be overlooked. The parts that are manufactured in your own plant are usually taken care of properly before many machines are built.

The cost of making each part is brought down to a minimum, and faulty design is corrected. In instances parts made of expensive materials and held to close limits are found to be unnecessary. A percentage of the suggestions for improving design and reducing cost can be credited to the men who have assembly drawings which show exactly what is required of the parts they are making. The parts of the machine which are purchased from another company are not checked as much as are the parts which are manufactured at your own plant.

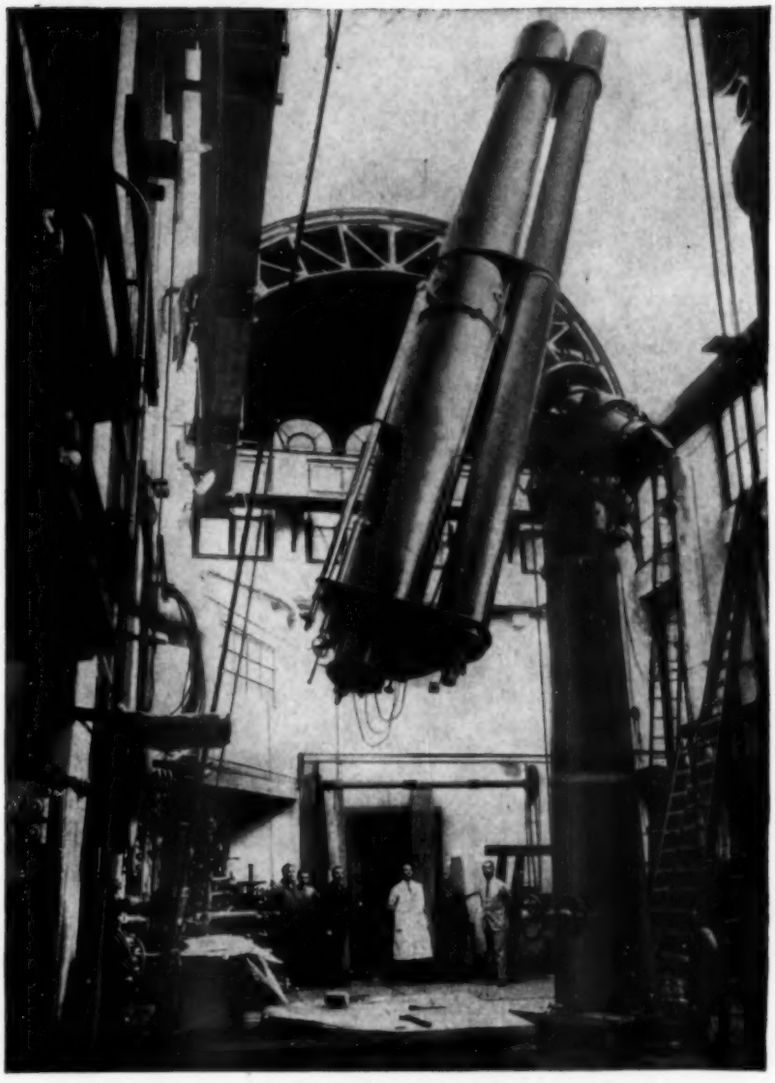
A blueprint of the part is sent to the manufacturer, and if his price is right, the parts are ordered, and if there is no trouble at assembly no more is thought of the purchased parts. —WILLIAM SALTZMAN.

Wide Open

Superintendent Williams has disappointed me! How can he expect to increase production by openly showing a distrust for his men? And what kind of a shop crew has he, if they must be watched? There is no greater blow to a man's pride than to suggest that he is dishonest, and there is no quicker way of suggesting this than to watch him. Placing the men on a lower level with their backs to the foremen is going to be the cause of discontent. The men will grumble among themselves. They will plan ways of stalling, ways of putting one over in spite of the watchdog. —ROY E. PETERSON, *E. H. Hotchkiss Company.*

Problems in Machining Astronomical Telescope Parts—II

HENRY SIMON



Telescope assembly hall at the Zeiss Works. By running the barrel-shaped roof out of the way, telescopes may be tested while still on the erection stand

TESTING is of prime importance in precision manufacture. Here is described the testing of a completed telescope and the tuning of regulator control springs for the driving clocks. The unusual job of planing dome rail rings is done on a modified machine with unusual accuracy and economy

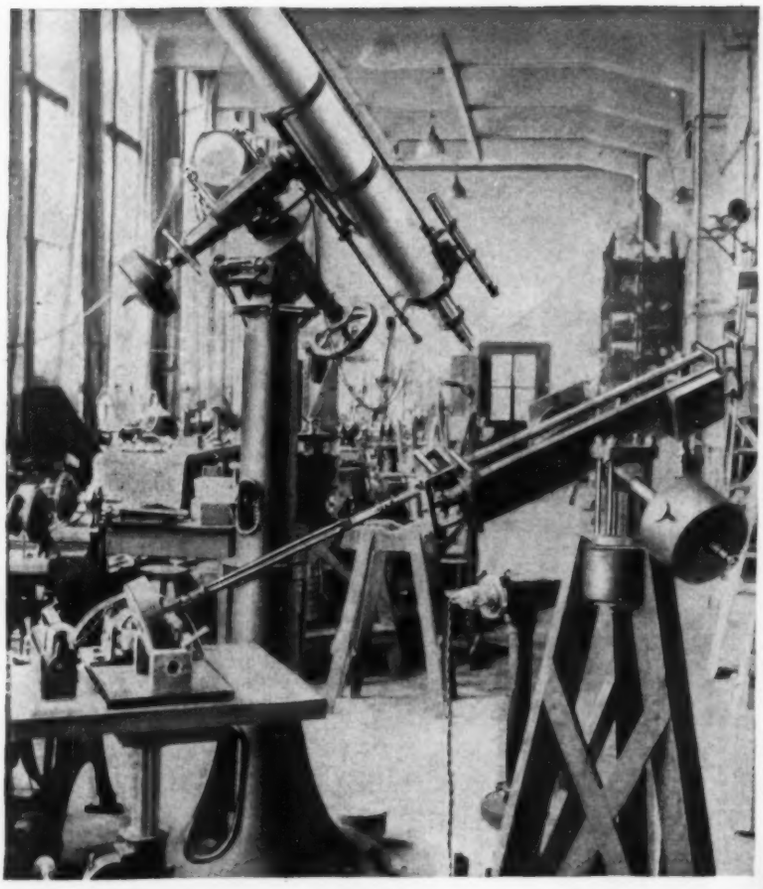
THE extraordinary variety of mechanical production tasks in astronomical engineering may be illustrated by three examples. There can be no much greater contrast as to character and purpose than between testing the running of a telescope by means of the "artificial star," tuning the accurate regulator control springs for the driving clock, and planing dome rail rings on a giant circular "planer." Each of these operations, moreover, is a striking example of how a given problem may be solved at low expense by the employment of logically correct methods.

The ultimate test of a telescope drive is the test of practice. Such a test is given each Zeiss telescope before it is sent out. To this end, the hall where the larger instruments are erected is covered by a traveling roof which may be run out of the way to permit the telescope to be tried out while still on the erection stand. It has been found desirable, however, to have some additional way of checking the running of the instrument, a need which has been solved by means of the "artificial star" device.

The basic idea of the device is the checking of the diurnal motion of the telescope by means of a tiny point of light, reflected by a concave mirror on the telescope to trace its path on a photographic plate. By imparting to the plate a uniform motion at an angle to the path of motion of the light point, the resultant line record will be straight only if the motion of the instrument is perfectly uniform. A wave will be registered for any deviation of the polar shaft from uniform rotation. Quick setting of the plate holder at any point on the recording stand is accomplished by mounting it on a half-nut on the lead screw. A resistance mounted on the motor stand permits control of the motor to give various lead-screw speeds. This permits the recording of a graph extending the entire diagonal width of the photographic plate.

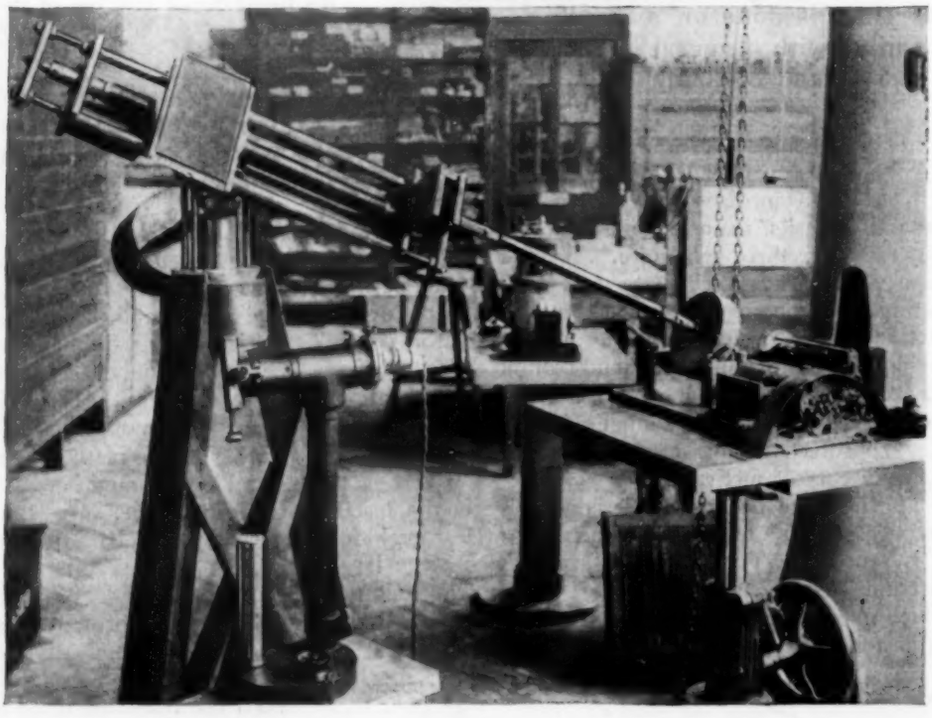
The testing procedure is extremely simple, and requires no special care. All that is necessary is to wait until nightfall, focus the point of light on the plate, and start both the telescope drive and the plate traversing screw.

Second of two articles by Mr. Simon. The first appeared on page 565 of this volume.

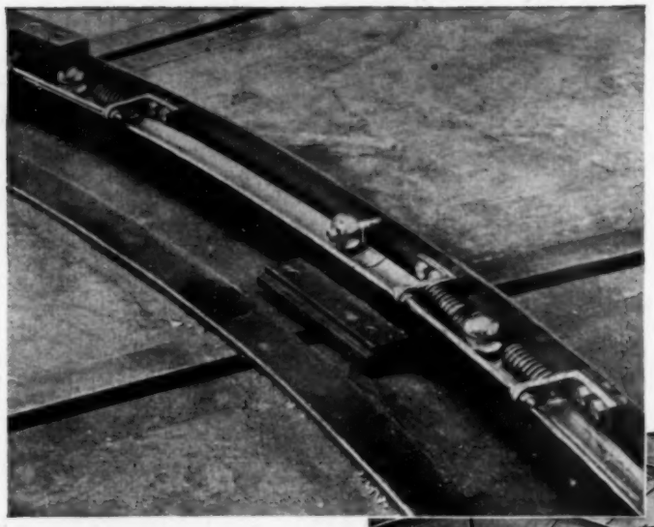


Testing a telescope with the artificial star. A concave mirror is attached to the telescope by a wooden frame and a pair of flat-link chains to reflect the beam of light from a tiny projector in front of the plate-supporting tripod to the photographic plate mounted on the slide at the right

Testing and tuning driving clock control springs. A spring is mounted across the parallel uprights. Differences of less than 0.001 in. determine whether or not a spring will pass. The operator is here reading deflection under initial load

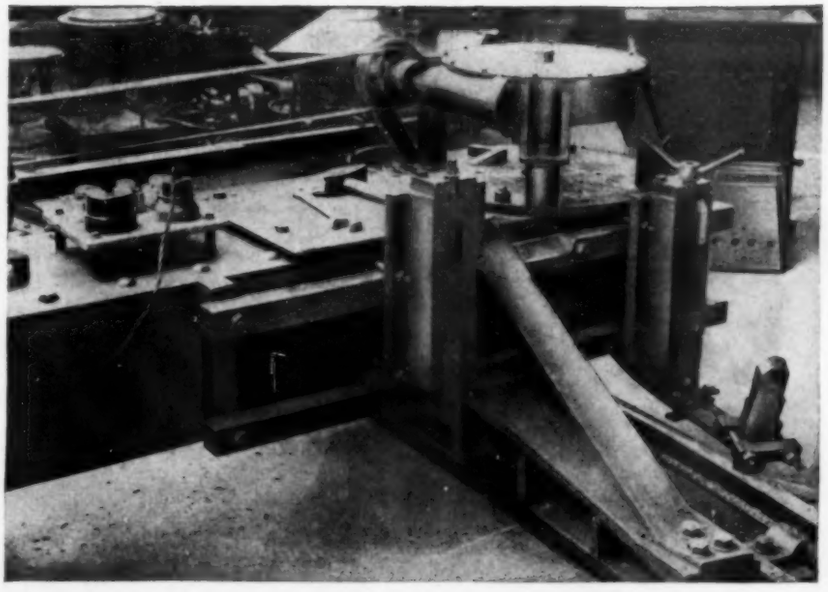


The recording stand consists of a tripod carrying a universally adjustable bed with a fine-pitch lead screw driven through a jointed shaft from a motor on the stand at the right. The photographic plate is placed in a standard holder revolvably mounted on the lead-screw half-nut. Directly in front, on a separate stand, is the projector which produces the star image



Circular rail track used in Zeiss telescope domes. The base ring (which rests on chairs on the foundation) and the top ring (later attached to the foot of the dome) are concaved on their inner surfaces to form races for large steel balls spaced about 2 ft. apart. The balls are held in position by cages on a skirt ring suspended from rollers running on the lower track

The giant rail ring "planer," capable of machining rings 50 ft. and over in diameter. The greatest distance between rail chairs at the outer periphery of the table is about 6 ft., 24 radial clamp rails being provided. Rings of a diameter exceeding the original capacity of the machine are handled by setting them on extensions such as may be seen at the lower right. Three rails are here being machined simultaneously



Rear view of the tool arm end, showing a spring-held cutter at the right and the worm reduction for driving the sprocket which pulls the arm around. The 3-step cone pulley provides arm speeds of 3, 6, and 11 min. per revolution

The resultant photographed line can indicate but one of three things. A smooth, straight line without "breaks" proves that the set of teeth under examination in the worm gear are true. A line showing an undulation proves the existence of some defect in the teeth concerned. A recurrent error at different points of the worm-wheel periphery indicates some trouble in the worm. By manipulating the telescope controls, it is possible to shift the declination axis with the mirror on it to any angle relative to the worm gear, and thereby to examine any set of teeth desired.

The interesting part about this testing arrangement is that it is independent of any exact speed. This is because the method employed avoids introducing the speed of revolution of the telescope into the problem, but confines itself solely to recording the existence or non-existence of periodic variations in the angular velocity, which is all that is necessary to prove the existence or non-existence of defects in the worm-wheel or worm.

Practically the only condition for success is that the plate be given a constant uniform motion, a requirement which is easily met. By examining the record line with a glass plate ruled with a pair of close parallel hairlines, almost infinitesimal errors may be detected. An extraordinarily sensitive and absolutely positive result is thus obtained in record form with a relatively cheap and non-sensitive piece of equipment.

The speed of the new type electric driving clock regulator depends on the action of two leaf springs. Since the function of these springs is analogous to that of the hair spring in a watch escapement, their exactly correct strength and curvature are matters of vital importance. A simple, but highly sensitive, instrument is employed in checking them. The device consists of a base block bearing three flat-stock uprights, one carrying a microscope, the other two having knife edges with pins at their upper ends which engage the end holes of the spring to be tested. One of these latter uprights is screwed rigidly to the base, while the other rocks in a narrow groove in the base surface. Suspended from the middle of the spring and located by a pin in the center hole of the spring is a hanger carrying a weight pan. At the bottom, this pan carries a vibration damper in the shape of a sheet-metal cross, which by immersion in a bath of heavy oil holds the device quiet during observation.

Deflection of the spring is read from a "spider web" glass scale attached to the front of the center hanger. Each spring is first tested with a small constant weight which straightens it but slightly, then with an initial weight large enough almost to flatten it, through a succession of $1\frac{1}{2}$-oz. steps. Readings are taken at each step and checked against a corresponding limit figure. Corrections are made by peening with a hammer, and occasionally by filing.

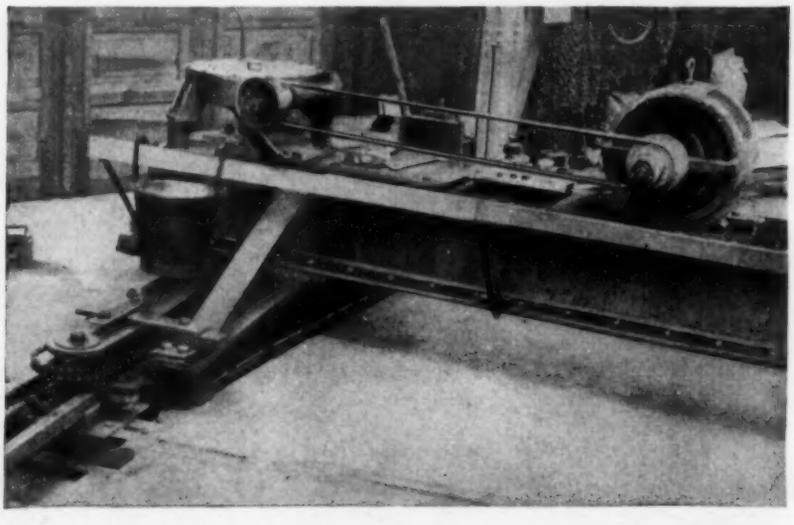
An idea of the delicacy of the operation may be conveyed by the statement that in the final practically flat position in which the spring later works, height differences of a ten-thousandth of an inch within individual "load steps" are considered in testing. The microscope allows detection of much smaller differences.

A striking instance of how a troublesome problem may be solved by simple and inexpensive means is the giant circular "planer" built in the Works for grooving the circular rails upon which Zeiss telescope domes are carried. While these annular rails run to a diameter of 50 ft. and over, they are secondary adjuncts warranting only limited expense for machining, which a few trials showed to be enormously exceeded by having them made elsewhere on the conventional type of heavy turning mill.

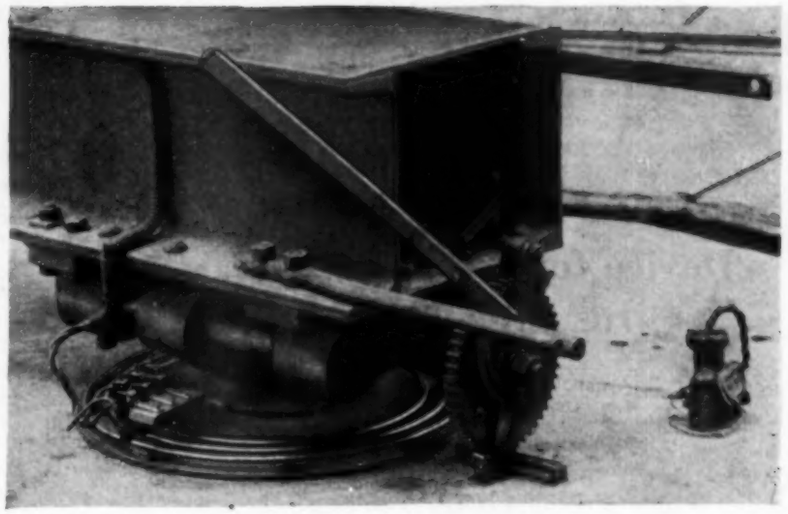
Briefly, the planer consists of a level concrete bed containing a number of radial T-grooved rails flush with the bed surface, and a radial tool arm in which one end is pivoted at the center of the bed while the other is driven by a motor along a peripheral track. By shifting the chairs in the T-slot rails and adjusting the cutters along to tool arm, rings of any desired diameter can be accurately machined. In addition to finishing rail rings of any desired dimension, the extensive bed of the planer is regularly used for the construction and test assembly of domes of any size, as well as for a variety of other purposes where a large enclosed space is required.

Since the erection of the machine, it has been found necessary to turn rings of somewhat larger diameter. This has been readily accomplished by the use of extensions spaced more closely together and placed on a lower level to miss the annular track of the tool arm. It is, indeed, one of the advantages of this "makeshift that is not a makeshift" that practically any extension of its capacity may be made at relatively trifling cost.

Exceedingly interesting is the manner in which the problem of providing an accurate peripheral bearing for the tool arm was solved. It must be remembered that while it would be easy to cut an exact bearing once the tool existed, the problem of generating a solid and exactly true circular track 150 ft. long when there is nothing



The block bearing and arc-shaped sliding foot of the tool arm. The small blocks spaced about the periphery are hardened and accurately surfaced to support the sliding foot casting, which may be seen just within the circular rack. Action of the tool arm wipes these blocks clean, and the interrupted surface prevents foreign matter from working under the bearing surface. The sliding foot is always carried on at least four of the blocks



Pivotal bearing of tool arm, showing bus bars for current supply and ratchet radial feed. The Y-shaped pivotal cradle on which the tool arm revolves has two lugs through which the bars of the arm base block go. This arrangement permits radial motion of the arm for a distance of several inches, controlled by a ratchet lever and wheel. A small stop set in the concrete base, which may be seen just below the ratchet wheel, can be utilized to provide automatic feed by tripping the lower end of the ratchet arm at each revolution

to do it with is a very different matter. The solution is as uncommon as it is effective, and combines practically every conceivable advantage. It consists in producing an interrupted sliding surface composed of a number of individual hardened and accurately surfaced steel blocks spaced at regular intervals along the periphery of the circular concrete base, and which support a long arc-shaped sliding foot under the outer end of the tool arm.

This design not only reduces the formidable problem of generating a true bearing to an innocuous job easily performed with transit and level, but renders it possible to make corrections easily at any later time. Moreover, under the exposed condition of the bearing, the interrupted track is just what is needed, inasmuch as it prevents any foreign matter from working under the bearing surface.

The radial tool arm is held down only by its weight, thus permitting the arm to be moved out of the way by a crane when the table space is needed for other purposes. The pivotal end has a base block with two bars which are sliding fits in the two lugs of the pivotal cradle in which the tool arm revolves. By means of a screw worked by a ratchet lever and wheel, the tool arm may be shifted radially several inches on its cradle. Radial movement may be accomplished semi-automatically by setting the ratchet so that the lower end of the lever is tripped at each revolution by a floor stop.

The sliding foot at the outer end of the tool arm is a steel casting braced to the body of the arm by straps. Just ahead of the foot is the "business end" of the drive. A peripheral swinging frame accommodates a flat chain driven by the worm reduction from the motor and driving a sprocket at its front end. This sprocket drives the rack-engaging pinion, by means of which the arm is pulled around. The rack is formed of channel iron with pin teeth, and is seated in chairs upon the radial rail extensions. Radial irregularities in the track are compensated for by the swinging design of the frame, which being pivoted at the tool-arm body end, maintains the sprocket in uinform contact with the rack by means of a roller running on the back of the rack.

Cutters are sprung by being held at the upturned end of a heavy flat bar which projects from the rear end of a clamp frame. The cutter may thus be employed at any desired position along the tool arm, and several rails may be cut simultaneously. Some idea of the cuts taken by these simple tools may be had from the chips seen lying in their wakes.

Rails are first machined square across the top, then chamfered on both sides. The steps in machining the concave groove are roughing out the groove with a square-edged tool in a series of steps from either side toward the center, and finishing with a concave tool of the required shape. Feeds are 0.025 in. radially and 0.005 in. vertically, depending upon the cut. Soap water is used for all but the last step in cutting, where turpentine is applied. The time required for completing a rail ring varies from 6 to 35 hours, depending on its size.

■

Experience Exchange vs. Trade Secrecy
Discussion

W. R. NEEDHAM
Engineer, Design Department
English Electric Company, Ltd.

THE *American Machinist* reference to Dr. Hermann Schoening's recommendations on page 154, Vol. 73, should be studied carefully. The doctor is in line with progressive thought when he pleads for greater co-operation and increasing exchange of ideas based upon knowledge and experience. The *American Machinist* is one of the most important media whence such valuable information may be culled. It is as the result of this principle that so much which is directly useful appears in the pages of the technical press. The usefulness of that press is acknowledged by engineers all over the world. Do those engineers pause to think how greatly that usefulness depends upon a free trade in ideas?

Progressives nowadays know how to classify the man or the firm habitually secretive. Except in the case of the hardly won patent process or invention, secrecy very largely defeats its own ends. What is withheld is generally an unimportant drop compared with the volume otherwise to be received in the exchange of ideas. Mankind is—and engineers are in particular—heir of the ages. There is a shrewd suspicion that the company, like the individual, which invariably keeps information under lock and key suffers from an inferiority complex. Most men who act on this plan fail to impress others with their personality or qualifications.

IDEAS FROM PRACTICAL MEN

Device for Winding Fine Insulated Wire

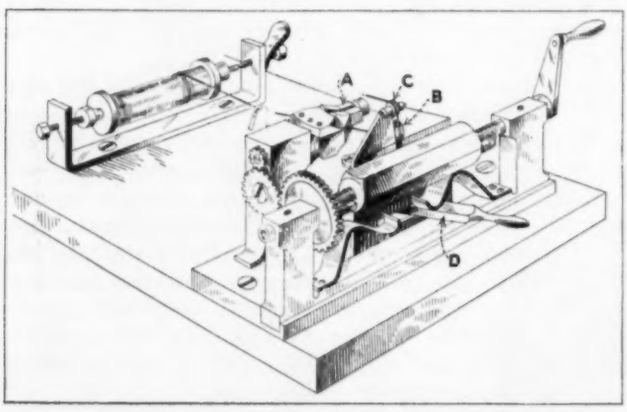
CHARLES H. WILLEY
Assistant Plant Superintendent, Hoyt Electrical Works

SILK-INSULATED copper wire, 0.0025 in. in diameter, wound in uniform layers on an aluminum form, is used for the moving coil of electric meters of the D'Arsonval type.

Formerly, the guiding of the wire was done by the operator's fingers, depending upon her skill to lay the turns evenly, a large magnifying glass being suspended above the form to aid her sight. As the operation was comparatively slow, we designed and built the device shown in the illustration.

In operation, the aluminum form is held on the specially-designed expansion mandrel *A*, while the spool of wire is placed on a mandrel in a bracket at the rear. The wire passes under a hook to the under side of the pulley *B*, passing upward and over the pulley *C*, and thence to the form. These two pulleys are mounted on a bracket attached to a sliding carriage that can be made to travel lengthwise of the device, in either direction, at the will of the operator. This motion is controlled by a screw having right- and left-hand threads on its respective ends. A pivoted arm having quarter nuts of opposite hands at the ends is attached to the carriage, and either of the quarter nuts can be brought into engagement with the corresponding threads on the screw by shifting the lever *D* to the right or left.

When the lever is shifted in one direction, the quarter nut on one end of the pivoted arm engages the threads on that end of the screw, causing the carriage and the guiding pulleys to travel in one direction, and to lay the turns of wire evenly on the form. When the layer of wire reaches the end of the form, the lever is shifted in the opposite direction, disengaging the quarter nut of one hand from the screw and engaging the quarter nut of the other hand, thus reversing the direction of travel of the carriage and the pulleys. In moving the lever in either direction, it passes either under or over one of the two flat springs attached to the bed of the device, keeping the quarter nut in engagement with the screw.



As the gearing between the mandrel on which the form is held and the screw is in the ratio of 10 to 1, ten turns of wire are laid on the form at each revolution of the screw, and as the screw has 40 threads per in., the turns of the wire are laid close together.

The best production when the coils were wound by hand was 15 per hour. By the use of the device described, the production has been stepped up to 35 per hour.

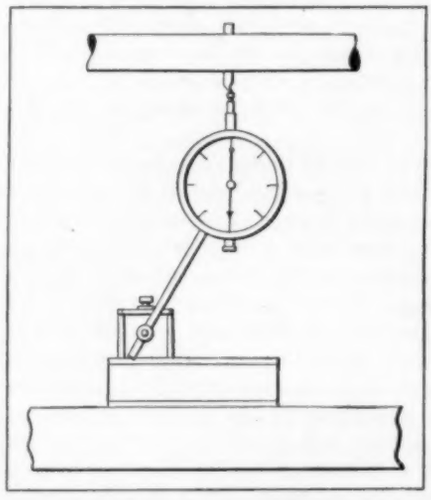
■

Setting Tools for Precision Boring
Discussion

CHARLES KUGLER

The method of setting boring-bar cutters described by Ernest Foldvary, in an article under the title given above, on page 26, Vol. 74, of the *American Machinist*, can be applied only under ideal conditions, the like of which I have never seen in horizontal boring mills.

A method of setting the cutter that I can recommend, and one that is independent of the condition of either the machine or the boring bar, is shown in the sketch at the left. After a trial hole has been bored and measured, and with a dial indicator placed as shown, the cutter is moved an amount equal to one half the difference between the diameter of the trial hole and that of the finished hole, as registered by the indicator. The hole can now be bored to the finished size, eliminating the cut and try method.

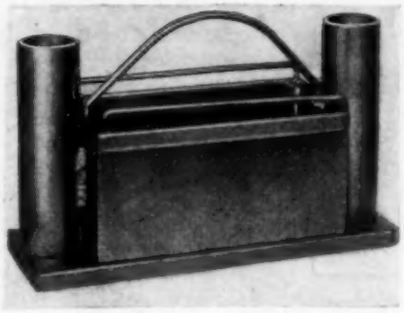


■

Insulated Box for Welding Wire

L. B. THOMPSON

In visiting the plant of an electric company, I saw the device illustrated. It is for holding welding wire; new wire as well as scrap ends. The box is insulated by a board fastened to the bottom. By loosening the wire clamps on the torch, the short ends of wire can be dumped in the box by knocking the torch on the raised



wires at the sides of the top. Thus the operator does not have to touch the hot wire or the hot part of the holder, eliminating the danger of burned fingers. The full-length pieces of wire are stored in the two vertical tubes welded to the ends of the box.

Formerly, the short ends of wire were carelessly mixed with other scrap and sold as mixed scrap at a price much less than its worth. The operators are now required to return all the unused ends of wire before receiving a supply of full lengths. This method has resulted in a substantial saving in wire, and a much better price for the scrap ends, since they are not mixed with other scrap.

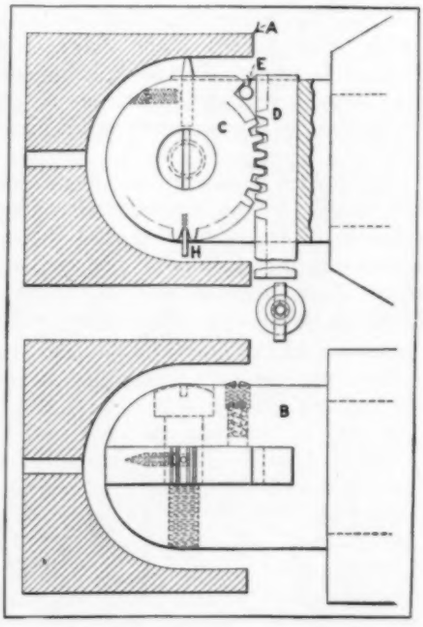
■

Boring Bar with Spherical Attachment

DANIEL GERRILD

Blind holes having spherical bottoms are sometimes required for special purposes, and a boring bar equipped with an attachment for producing such holes is shown in the illustration. The work is roughed out to within, say, $\frac{1}{32}$ in. before the bar is used.

Referring to the illustration, *A* represents a cross-section of the work to be machined, while *B* represents the boring bar, which consists of a round piece of machine steel enough smaller than the hole to be bored to allow for chip clearance. It has a spherical end in which a deep slot has been cut to receive the gear *C* and the rack *D*. In use, the bar is held in the turret of the lathe. The gear, revolving about a shoulder screw in the bar, carries a toolbit held in place by a setscrew, the toolbit being offset to bring its lower surface on the center line. In boring the straight part of the hole the gear is prevented from revolving by the pin *E*, which contacts with a projection on the gear. A spring plunger dampens the free motion of the gear.



A removable gage pin is placed between two teeth in the gear, opposite the toolbit, in order to obtain means of accurate measurement for the setting of the toolbit. By means of a short bar held in the toolpost, the action of the cross-feed pushes the rack in a direction away from the operator, thus rotating the gear in a counterclockwise direction. A line previously scribed on the rack shows when the toolbit has reached the center line of the work. The bar is used as an ordinary boring bar until the toolbit reaches the depth of the straight part of the hole, when the longitudinal feed is disengaged and the cross-feed is engaged, operating the rack and causing the toolbit to describe an arc.

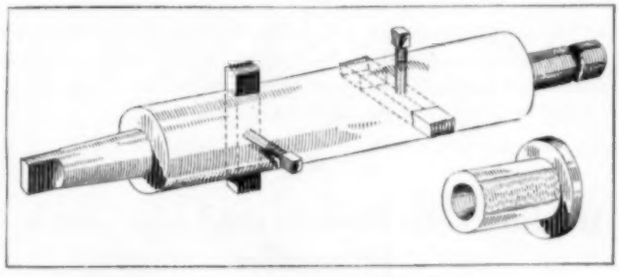
After a cut has been completed, the bar is withdrawn from the work and the rack is pushed back until the projection on the gear again contacts with the pin *E*. Then the cycle is repeated on the next piece. Where holes are deeper than will permit the use of the rack in its present position in the bar, a deeper slot can be cut in the bar, and two or more intermediate gears can be placed between the rack and the gear. It is necessary to use an even number of intermediate gears to prevent the gear carrying the toolbit from revolving in the opposite direction to that intended. It is also necessary that the gear meshing with the rack have the same number of teeth as the one carrying the toolbit. Otherwise, the correct ratio of motion between the rack and the gear carrying the toolbit will not be preserved.

■

Threading on a Horizontal Boring Machine—*Discussion*

JOHN KOPP
Simonds Saw & Steel Company

Reading the article by W. L. Waterhouse, under the title given above, on page 294, Vol. 74, of the *American Machinist*, reminded me of a job of threading I once did on a similar machine. Two holes were bored and



threaded in large steam valves for attaching the seats. Formerly, after the boring had been done, the work was set up in the lathe on an angle plate. A plug was inserted in one of the holes and the work was shifted until the plug ran true. Threads were then roughly chased in the hole, being afterward sized by a tap. The operation was repeated for the second hole.

For the purpose of doing all the work in the boring mill, I made the bar shown in the illustration. The outboard end was threaded to fit a sleeve nut held in the outboard support. Two chasers were fitted in the bar at right angles to each other. The chasers were of different size, one being for roughing and the other for sizing and finishing. The chasers and the thread on the

bar were, of course, both of exactly the same pitch.

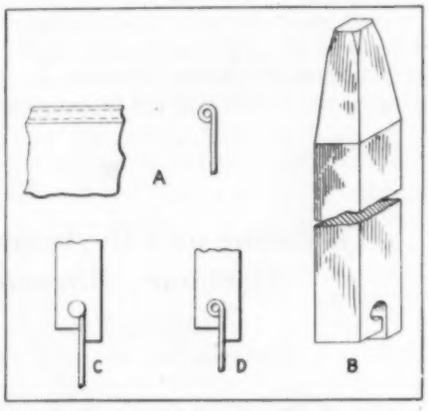
In operation, after one hole had been bored, the bar carrying the chasers was put in place and keyed to the spindle, the threaded end being engaged in the sleeve nut. The feed was disengaged, permitting the threaded end of the bar to act as a lead screw and pull the chasers through the work. The operation was, of course, repeated for the second hole. By the use of this device, the work was done in about one-half of the former time.

■

A Hand Beading Tool

HENRY W. BOEHLY
Machine Designer, Mergenthaler Linotype Company

There are occasions in the machine shop when the edges of some sheet-metal part have to be beaded, as shown at *A* in the illustration. Such work often proves to be troublesome, especially when a neat job is required. At *B* is a tool with which such a job can be done very easily. It has a slot with clearance enough to permit the entrance of the work, as at *C*. A hole of the diameter of the bead is drilled tangent to the far edge of the slot. If the hole is lapped or otherwise polished, the metal will bead more easily.



In operation, the tool is entered over the edge of the work, as at *C*, and when struck with a hammer the bead will be formed, as at *D*. Oiling the tool will help considerably. In forming a bead of large diameter, a pin should be slipped under the bead when it has been partially formed. The pin will prevent the edge of the metal from breaking down and will have the same effect as what is known in die parlance as "wiring"

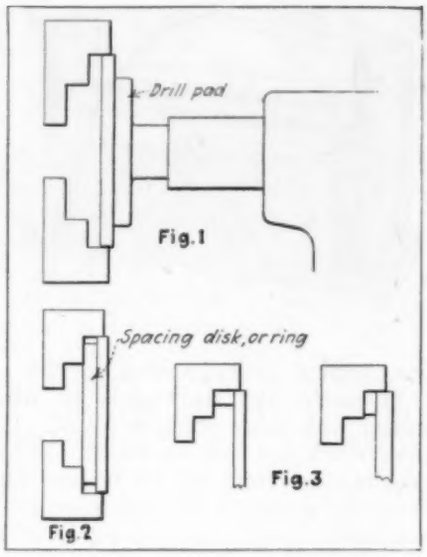
■

Holding Thin Work in the Lathe Chuck
Discussion

H. J. GUSTAV KOPSCH
Stuyvesant High School

As usual, I read carefully through all the issues of the *American Machinist*. The article by Richard H. Kiddle, under the title given above, on page 183, Vol. 74, while describing a very clever idea, seems to invite the following friendly comment:

The blocks made to fit the jaws of a certain chuck cannot be used on another chuck having jaws of a different size, since the little wire loops must fit snugly to be of any use. Most mechanics have, at one time or another, had to face thin disks or plates. The customary and quite satisfactory way is to put the piece in the chuck and tighten the jaws just enough to prevent it from falling out. Then to true it by bringing the tailstock spindle, or better still, the drill pad, against it and then tighten the jaws firmly upon it. See Fig. 1. If a great quantity of disks are to be faced, a spacing disk, or a ring of the proper thickness but slightly smaller in diameter, is placed behind them. See Fig. 2. I know of no occasion where one of these two ways would not do.



I certainly would not advise the use of hard grease or heavy oil to stick any small blocks to the chuck jaws, since it might cause an error in the resulting thickness of the disks, and might cause them to run out of true. However, if small spacing blocks are resorted to, why not make them of steel, and harden, grind and magnetize them? Also, make them rectangular instead of square. They will be held to the jaws by magnetism, and by placing them in different positions, as indicated in Fig. 3, work of various thicknesses can be accommodated, leaving enough protruding for the facing operation.

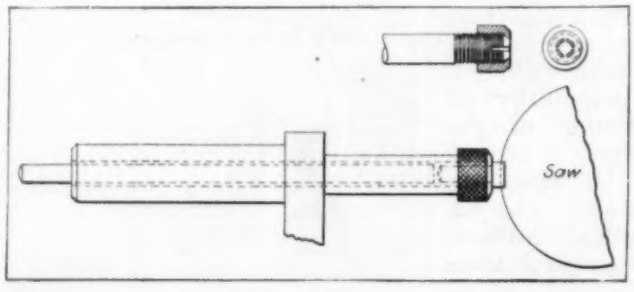
■

Fixture for Slotting Special Screws
Discussion

T. R. SILVER
Birmingham, England

While the device described by H. L. Wheeler in an article under the title given above, on page 769, Vol. 73, of the *American Machinist*, is ingenious, I think that Mr. Wheeler will agree with me that the device described herewith is an improvement on his method of holding the screws.

The holder shown in the illustration is bored out its full length for an ejector rod. The end holding the screw is threaded, beveled, and slit in three places. A nut having a restriction at one end of the bore, beveled to the same angle as that on the end of the holder, is fitted on the holder. An ejector rod fitted to the bore



of the holder completes the device. By this construction, the holder is substantially converted into a spring collet that is closed or opened by screwing the nut on or off. The nut can be round and knurled for a finger grip, or it can be hexagon for a wrench.

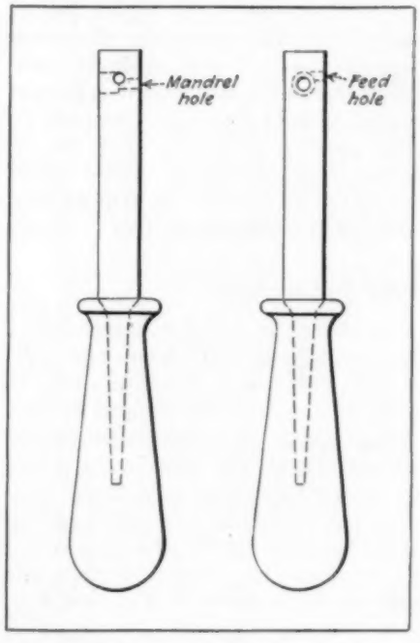
The holder will take screws of various diameters within certain limits, and will not injure the threads. It is obvious that a screw can be placed in the holder and held by tightening the nut in a much shorter time than it can be screwed into a tapped hole, especially if the threaded part is long. After slotting, it is necessary only to loosen the nut and push out the screw with the ejector rod.

■

Winding Springs in a Vise—*Discussion*

WARNER E. FREURE
Diemaker at the Motor Products Corporation

On page 292, Vol. 74, of the *American Machinist*, in an article under the title given above, R. L. Haselgrove says that the springs he wound in the vise could not be wound in the lathe. I have wound thousands of feet of such springs in a small bench lathe. The mandrel and one end of the wire were gripped in the chuck. The mandrel and the loose end of the wire were held between the thumb and the first finger of the right hand, and the spindle was revolved by pulling the belt with the left hand. A slight pressure of the right hand was maintained toward the chuck to keep the coils close together.



After winding about six inches of spring, the spindle was backed up to release the tension of the wire, the chuck was loosened and the part of the spring that was wound was pushed back into the hollow spindle. The mandrel was then pulled out to its former position, the chuck was tightened and the operation was repeated.

If the springs are wanted in quantity, they can be wound on a mandrel by using the conventional tool shown in the illustration. The wire is slightly bent on the end and is fed through the feed hole and the hole for the mandrel. The mandrel is then inserted through the hole provided for it in the tool, and the mandrel and the end of the wire are gripped in the chuck. The tailstock center is removed and the free end of the mandrel is allowed to enter the hole in the spindle to keep it from flopping around. About 18 in. of spring can be wound before pushing it back into the hollow spindle.

When enough of the spring has been wound to come out at the end of the hollow spindle, it should be entered in a pipe to prevent it from tangling as it revolves. The pipe need not be in line with the spindle, nor need it be straight. I have used a conveniently-located stair rail of pipe for the purpose. By this means I was able to wind springs about 50 ft. in length. When using the winding tool, it is not necessary to back up the lathe spindle before pushing the spring into it, since the tool will prevent the wire from springing back.

By using a mandrel made of music wire, I found that I could wind a much longer spring before pushing it into the spindle than by using one of softer material. Springs can be wound much quicker by either of the methods outlined above than by the method described by Mr. Haselgrove, since one does not lose the time required in finding the wooden blocks and making the clamp for holding the wire end on the mandrel. If no lathe is available and springs have to be wound by Mr. Haselgrove's method, the operation could be materially speeded up by using a crank on the mandrel instead of a wrench.

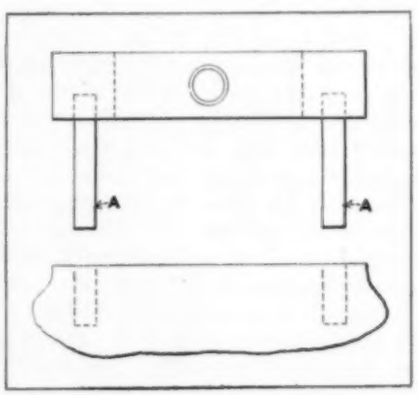
■

Automatic Return for the Ram of an Arbor Press

CHARLES R. WHITEHOUSE
Standards Engineer,
The Holtzer-Cabot Electric Company

The ram of an arbor press can be made self-returning to the open position by attaching the following simple devices: A collar fitted with two pins, such as is shown at *A*, is clamped to the upper part of the ram above the yoke. Two holes, larger than the pins but at the same center distance, are drilled in the top of the yoke. Springs of an inside diameter to fit freely on the pins and of an outside diameter to go freely in the holes, complete the equipment. The springs should be of a length that will lift the ram to the desired height, and the collar should be so positioned on the ram as to permit the ram to be lowered the required amount when the springs are compressed. The springs are, of course, placed in the holes in the top of the yoke and the pins in the collar are entered into them.

For the toolmaker, this arrangement is quite a labor saver, since all he has to do after using the press is to let go of the lever and the ram will return to its upper position through the action of the springs. Its greatest advantage, however, is where a great number of parts are to be assembled by pressing. While the ram is returning, the parts can be removed and others inserted, resulting in a time saving of fully 25 per cent. This figure is taken from



time studies taken on work done in an arbor press both before and after the returning device was applied.

At this plant we have put these attachments on a number of the small presses in the assembly department and find that they are a distinct advantage in lessening the fatigue of the operators. Of the attachments we have made, a 6-in. return of the ram is the greatest. The same attachments were tried on larger presses, but it was found that the heavy springs required took too much strength in operating. On the small presses, the attachments have been the most efficient of the many schemes we have tried.

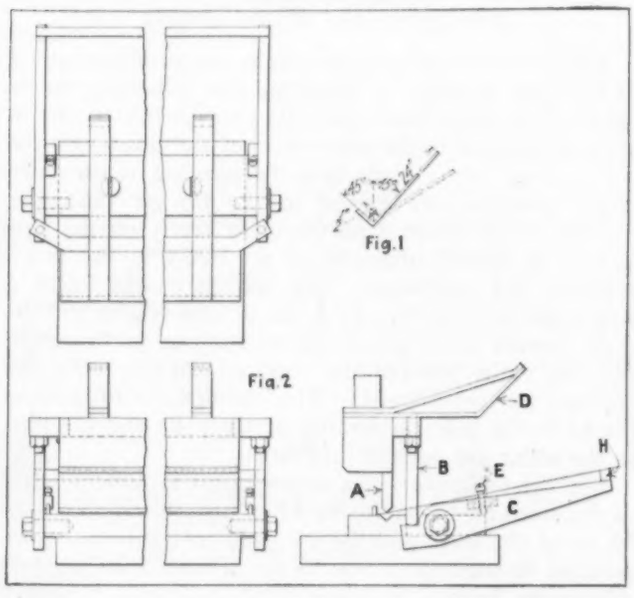
■

A Stock Lifter for Bending Tools

NORMAN B. MCKAY
Tool Designer, The Wilcox Laboratories

We had many pieces of sheet steel to be bent to a right angle at one end, as shown in Fig. 1. The steel was from $\frac{1}{32}$ to $\frac{1}{16}$ in. thick, and from 12 to 14 in. long, the width being anywhere from narrow strips to sheets as wide as the length of the die. Unless some means were devised for lifting the free end of the stock during bending, that end would not lift up on account of the short leverage of the bending tools, but would assume the shape indicated by the dotted lines.

The bending was done by the tools shown in Fig. 2,



in which figure the lifting device is included. At the same time that the punch *A* contacts with the stock, the rod *B* strikes the short end of the lever *C*, causing the long end to lift the free end of the stock. While the positive action of the lever raises the stock about $1\frac{1}{2}$ in. only, its momentum, due to the fast action of the press, throws up the free end of the stock against the under side of the bumper *D*. The adjusting screw *E* is to position the lever so that the stock will be held at the correct angle as its free end rests upon the cross-bar *H*. This angle is to be found only by experiment. The rod *B* is adjusted so as to strike the short end of the lever at the proper moment. The press runs at 90 strokes per minute, enabling fast production.

SEEN AND HEARD

●

Buffs and Fluffs

ONE can make a buff from almost any grade of muslin or sheeting, but scorching or fraying is more than likely to occur unless the material is especially designed for the purpose. Even the best grades of sheeting are said to present certain disadvantages in these respects, partly because a lighter and slacker twist of cotton is used in the filling than in the warp threads.

Research work conducted jointly by the Hanson-Van Winkle-Munning Company and the Pacific Mills is reported to have shown that a completely "balanced" fabric of Western cotton produces superior results. Such a fabric has the same weight, number and twist of threads in both warp and filler such as 88/88 or 68/68. The threads are tightly twisted, as experience has shown that buffs with loose "airiated" threads fluff and burn more readily. —*N*

Going Back to Nature

BUYING a gas stove is serious business with a housewife, and when she does buy one of the higher priced models with the newer marble-ized porcelain, the finish must be a good reproduction. Early methods were responsible for so-called marble finishes, but it remained for the Chicago Vitreous Enamel Products Company to duplicate nature. The indirect process is used, but an etched marble slab is substituted for an etched metal plate. The true veins of the marble are reproduced, and the cost of application should be materially less —*P.*

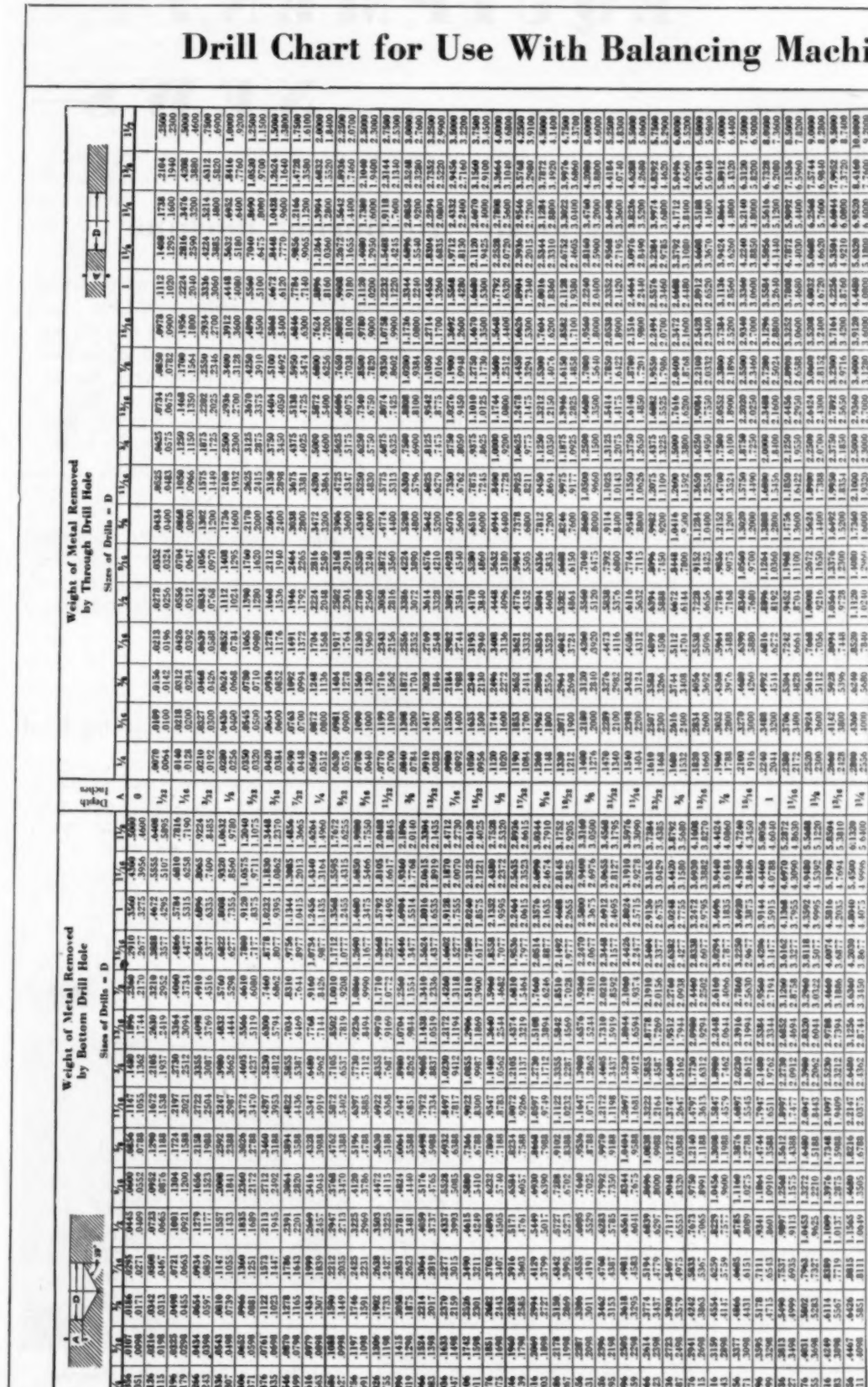
Group Drives Again

IDEAS change in shop drives as in other lines. Years ago the argument between advocates of group and individual drives waxed loud and long. Sporadic cases of extreme individualizing of motor drives cropped up, but group drives were quite popular. Of late, however, the individual drive has many friends and seems to be growing in favor. The accord is not entirely unanimous, however, as a shop recently visited is reverting to group drives in some departments, on the basis of first cost and power consumption. It would be easier if ideas would stay put, but it would not be progress. —*J.R.G.*

Apprentice Training

"BEEN READING quite a bit in *Machinist* lately about apprentice training," said a machine-shop executive of the Nineties. "They sure give an apprentice a lot more these days than they used to. Now they have lockers, showers, ball teams, bonuses, bands, and all sorts of things. Our apprentices didn't have such opportunities, and we still thought we were being good to 'em. After they'd been with us three months they got three hammer forgings, and they could use company tools on their own time to fix up a set of hammers. After the first year they got a pair of calipers, and another pair after each of the others. When they finished up, if they were real good, they got a thread gage and a job—and both of us felt lucky." —*T*

Drill Chart for Use With Balancing Machines


Weight of Metal Removed by Bottom Drill Hole
Sizes of Drills – D
Weight of Metal Removed by Through Drill Hole
Sizes of Drills – D
Depth factors
A
D

This chart gives weight of metal for steel and cast iron removed by drilling.
Upper figures in heavy type indicate weight for steel. Lower figures in light type indicate weight for cast iron.
For example, if ⅞ ounce of steel is to be removed using a ⅜" drill with 59° point, follow down vertical column under ⅜" on left side of chart until reaching .1902 which is nearest decimal equivalent of ⅞ ounce. This amount .1902 ounce is in horizontal line with 31" which is depth required for steel. For cast iron ⅜" depth is indicated to remove same weight of ⅞ ounce, using same drill.

WEIGHT OF METAL IN OUNCES REMOVED BY DRILLING—HEAVY TYPE=STEEL—LIGHT TYPE=CAST IRON

Abstracted from Catalog No. 50 of the Tinius Olsen Testing Machine Company

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SHOP EQUIPMENT NEWS

Kellocater Jig-Boring Machine, which employs vernier scales for setting table movements to 0.0002 in.

Kellocater Jig-Boring Machine

MEASUREMENT by vernier scales is the principle of the "Kellocater" jig-boring machine announced by the Keller Mechanical Engineering Corporation, 70 Washington St., Brooklyn, N. Y. One scale measures the longitudinal movement and the other the transverse movement. They eliminate the use of several measuring elements. Settings are made without moving the table or work by lining up the two sharply drawn graduations, one on the scale with the other on the vernier. Easy reading is afforded by the 10-power flat-field magnifying glass, which is equipped with a built-in electric light. With this construction the operator has merely to adjust a light and sensitive instrument, rather than to position a considerable mass at a precise location.

In connection with the setting of the vernier, an adjusting screw is provided, so that the scale and vernier can be lined up to the nearest even inch. Thus, the operator need not add or subtract decimals or fractions in determining successive locations. The decimal required can be read direct from the blue print and the vernier set accordingly. Another feature is the electrical stop by which location becomes automatic. Snapping a toggle switch moves the table at uniform speed by means of a leadscrew driven by a magnetic clutch. As the contact fastened to the table touches the anvil of the vernier slider, the magnetic clutch releases the leadscrew and the table stops at location within an accuracy of 0.0002 in. A lock is also incorporated in the mechanism to prevent slippage of the table over an oil film, thereby keeping the accuracy of the setting intact.

Another factor contributing to speedy operation is the ability to bore one hole while setting for the next. By using the automatic reversible spindle feed, the operator is free to make the next setting. Changing tools is rapidly done by means of a quick-change collet. A quarter turn of the nut locks the collet and centers it.

A large extra-heavy spindle, made of chrome-nickel steel, is employed in the Kellocater jig-boring machine. It runs in high precision ball bearings and eight-spindle speeds are obtainable—77 to 1,750 r.p.m. Four speeds are obtained through an open belt and four through backgears. The change from open belt to back gears is effected conveniently. Two reversible automatic feeds—0.002 in. and 0.005 in.—are available, together with a choice of hand-wheel and hand-lever feeds. An automatic positive depth stop with scale and pointer is attached to the spindle head.

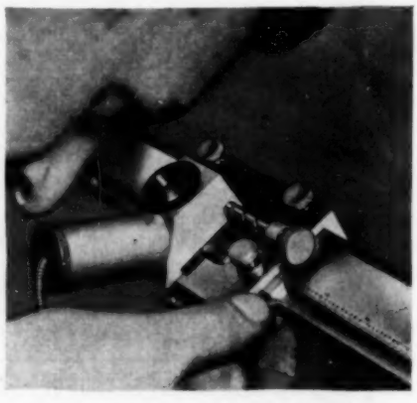
The driving mechanism for the machine, including the magnetic clutch, is inclosed in a box-shaped bed. The spindle drive motor is mounted on a hinged bracket, which is adjustable for belt tensioning. Both the base and the over-arm are heavily built, the latter being gibbed and furnished with a crank for a vertical adjustment of 6 in.

Specifications: table travel, horizontal, 18 in., transverse, 12 in.; table working surface, 14x21 in.; distance from table to spindle end, $2\frac{1}{2}$ in. minimum, $14\frac{1}{2}$ in. maximum; distance from spindle center to face of column, 14 in.; spindle motor, $\frac{1}{2}$ hp.; vertical adjustment of spindle bracket, 6 in.; spindle quill travel, 6 in.; dimensions, 55x45x78-in. high; weight, 1,375 lb.

The Keller electrically controlled automatic stop described above may be installed on other machines, such as horizontal boring mills and milling machines.

"Armite" Hard-Facing Rod

Three grades of a hard-facing rod have been placed on the market by the Armite Laboratories, 318 West Ninth St., Los Angeles, Calif. These three grades are Nos. 1, 2 and Special. The No. 1 has less toughness than others, and should not be used where great amount of shock or vibration is encountered. No. 2 is extremely tough, has the characteristics of No. 1 and Special, with



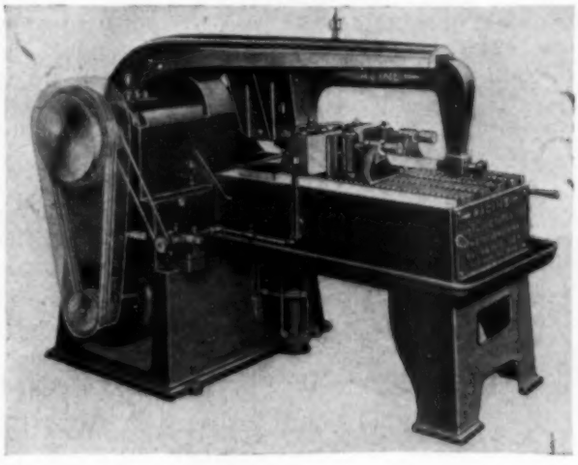
Kellocater vernier scale, showing the 10-power magnifying glass and built-in electric light

the exception of extreme hardness. It can be forged and is impact-proof. Armite Special has a free, clear flowing quality, low conductivity, a good plastic range, and is non-oxidizing even at the melting point of 2,300 deg. F. Its hardness and toughness are of high order. The Brinell hardness of the three types is as follows: No. 1—682; No. 2—415; and Special —503. All three grades form little slag and will weld to ordinary steel without the latter being burnished or removing old facing material.

The company is also manufacturing "Arcweld," a granulated material for depositing hard-facings by means of the electric arc, and "Autoweld," a stick form tungsten-carbide material. Autoweld is made in ¼ in. sticks from 10 to 11 in. long and is used with any standard make of electric arc welding machine. Armite inserts and compounds are also made for use on oil-well drilling bits and power shovel teeth and other places where abrasion-resisting facings must be had.

Racine Hydraulic Production Sawing Machines

Shear-cut hydraulic production sawing machines are now manufactured by the Racine Tool & Machine Company, Racine, Wis., in 10x10, 12x12, and 10x16-in. sizes. Each incorporates the "Oilmotor," a compact, self-contained pumping device, supplying oil at uniform pressure throughout the entire system. It has within itself an automatic means for control of the oil volume pumped. The amount of feed is set by the operator for different kinds and sizes of stock and the oil volume increases or decreases slightly in accordance with the area and character of metal encountered by the blade. The hydraulic pressure is positive and will not allow the blade to flinch or raise from the work while cutting. If a resistance is set up, however, that exceeds the allowable pressure on the blade, the Oilmotor automatically reduces the feed momentarily. However, the oil pressure that holds the blade to its work does not drop.



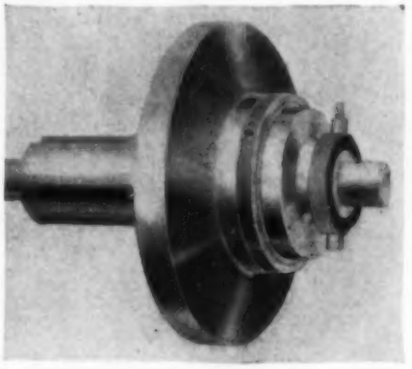
The feed, lift, clutch, and rapid traverse of these machines are all hydraulically operated. The entire control of the machine is had through a single lever at the front. A 3-speed geared head is another feature.

The table is fitted with replaceable plates 1½-in. thick. On the top of these plates are mounted a double set of vise jaws, providing a means of holding the stock on both sides of the blades. The saw guide of the machine is fitted with gibs at the top and on the side of the apron, so that the saw frame is held at the top and bottom, providing added rigidity. The slotted table construction permits chips to fall through into a large chip pan arranged to facilitate chip removal. Drive from the motor to the geared head is through V-belts. A 3-hp. motor is mounted on an adjustable hanger.

Dodge "Diamond-D" Friction Clutch

A completely inclosed disk clutch designed primarily for machinery applications, but adaptable for power transmission service, is being offered by the Dodge Manufacturing Corporation, Mishawaka, Ind. While large friction area is provided to insure the full rated horsepower being transmitted under moderate unit pressures, over-all compactness of dimensions has been attained. In both the engaged and disengaged positions the clutch is fully inclosed, assuring safety as well as protection against dust and dirt.

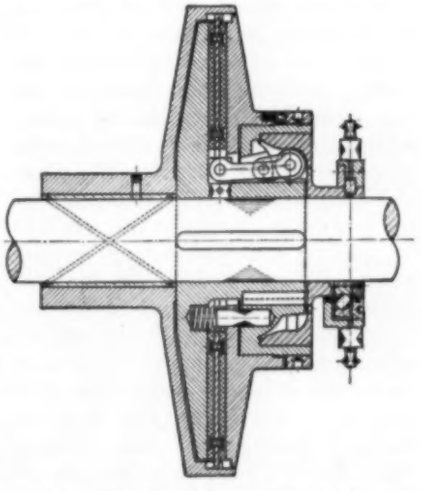
As the cross-sectional view shows the clutch consists of a laterally free friction disk capable of being clamped



Dodge "Diamond-D" Friction Clutch in disengaged position

between two heavy steel disks, one of which is keyed to the central shaft, which may be either the driving or driven member. At its periphery the friction disk engages through interlocking serrations and slots the other rotating member in the form of a sleeve with a conical bell end. The sleeve has a key slot for attachment to a pulley, gear, or sprocket hub. Compression of the disk between the clutch faces is by three toggle members actuated by an internal cam of cylindrical form, which is moved lengthwise on the shaft by means of a slip ring and shifting yoke.

The friction disk consists of two ground asbestos disks riveted to a steel plate through which the torque is transmitted at its periphery. Either a heavy bronze slip ring or ball bearing unit is offered, both



Cross-section showing clutch in the engaged position

lubricated through a compression fitting in the yoke arm. The toggle is self-locking in the closed position, and in the open position the plates are kept free by coil springs, plus the centrifugal action of the toggle mechanism. Contact between the cam and toggles is through hardened steel rollers. Adjustment of the clutch is by a knurled self-locking ring, which, through the medium of a threaded sleeve, adjusts the distance between the two steel compressing disks. Movement of the slip ring is constant and is not affected by wear of the friction material or adjustment.

All parts are held to close tolerances to insure accurate assembly, balance, uniform throw, convenient adjustment, and interchangeability. All wearing members are hardened and ground.

"Universal" Automatic Polishing and Buffing Machine

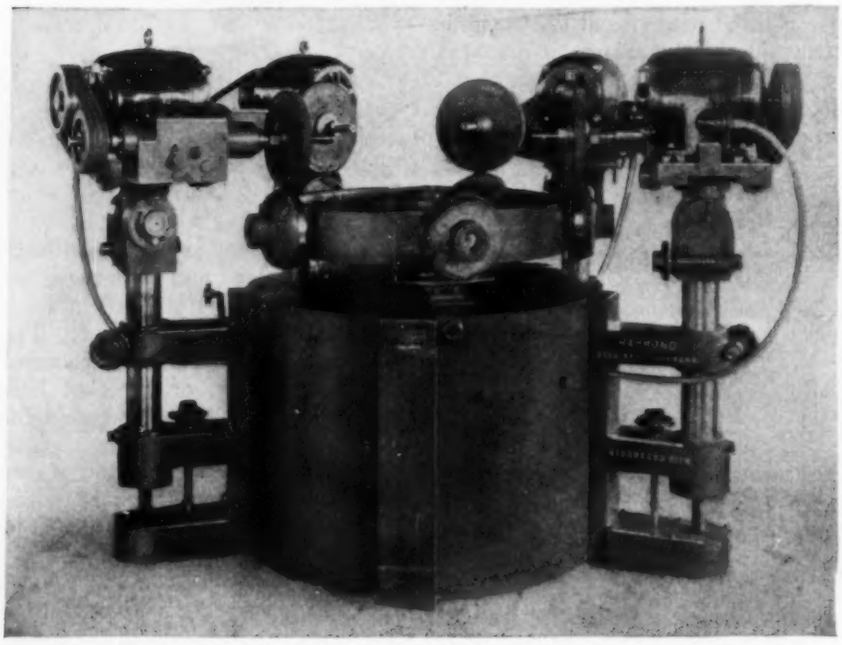


Fig. 1—Circular work required to be polished on the edge is taken care of by this setup on the "Universal" Automatic Polishing and Buffing Machine

A great variety of shapes can be polished automatically on the "Universal" automatic polishing and buffing machine announced by the Hammond Machinery Builders, Inc., Kalamazoo, Mich. This machine employs simple adapters for the work and is capable of any motion required for polishing. Whether the work to be polished is round, flat or beveled, means are incorporated in the machine so that the desired finish may be obtained. Should a horizontal revolving motion be required, such an arrangement is provided as shown in Fig. 1. The close-up Fig. 2 shows flat-iron bases which are polished with the reciprocating motion of platens on the work table. The table is indexed to stop at each polishing head, while at the operator's station, an automatic clutch stops the revolving fixtures to prevent injury to the operator while loading the pieces.

To simulate the yielding effect of human hands while holding the work to the wheel, this machine employs spring balances on the head so that any predetermined pressure or yield may be obtained. The spring adjustment is simple and is effected by the long vertical screw at the rear of the motor, as shown in Fig. 2. Differential gearing permits any desired feed to be obtained readily. Once a definite feeding rate has been established and recorded, it is easily duplicated on later set-ups. Either manual or automatic redressing of the wheel face with composition can be done at proper intervals.

Production with this machine varies with the class of work and is controlled only by the time required for actual polishing. The table can be adjusted to produce up to 2,000 pieces per hour, if required. The larger six- or seven-spindle machine (not illustrated) is generally used for this output rate. The polishing wheel spindles are driven by multi V-belts and the speed can be varied by changing the sheave diameters. Spindle bearings have a self-contained oscillating feature, which may be thrown in or out by a lever on the outside of the bearings. The work table is mounted on anti-friction bearings, and is indexed by a sturdy Geneva motion.

"Prest-O-Weld" Types W-105&6 Blowpipes

Two welding blowpipes have been added to the line of "Prest-O-Weld" medium-pressure apparatus built by the Linde Air Products Company, 30 East 42nd Street, New York, N. Y. A detachable valve body, to which the

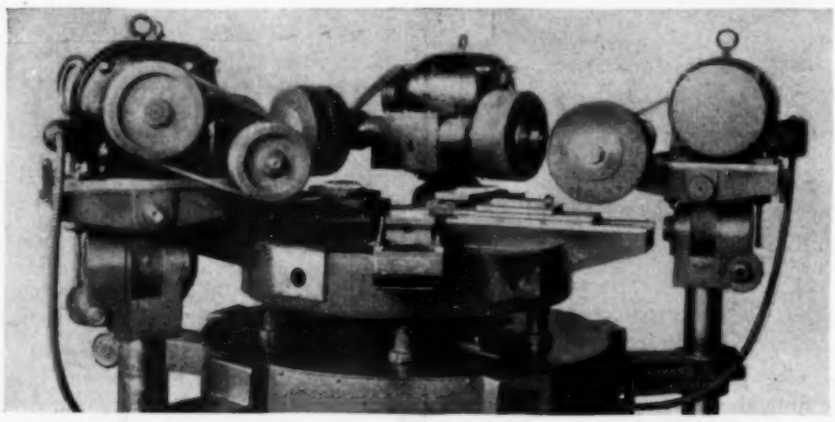
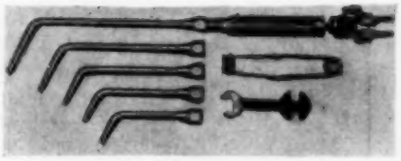
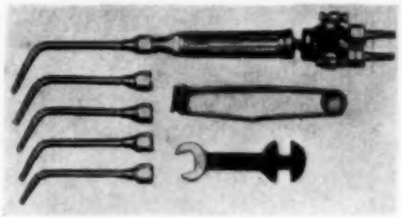


Fig. 2—Flat pieces are reciprocated beneath the polishing wheels in this setup



"Prest-O-Weld" Type W-105 Welding Blowpipe



"Prest-O-Weld" Type W-106 Welding Blowpipe

handle is secured by a simple locking device, enables the operator to change quickly from the standard to different handles without detaching the hose or hose connections and without the use of a wrench. These two additions, the Types W-105 and W-106 welding blowpipes, have been designed to give users a medium-pressure blowpipe comparable in range to the "Oxweld" Type W-17 welding blowpipe. Both blowpipes are designed for use with one-piece, hard-drawn copper welding tips. Although regularly supplied with a head angle of 60 deg., this may be changed.

Ten different sizes of tips, Nos. 4 to 13 inclusive, are available for use with the Type W-105 handle. As furnished, it includes tips Nos. 4, 6, 8, 10, and 12. A stem adaptor is available so that tips for the Type W-107 aircraft welding blowpipe may be used. This makes the Type W-105 adaptable for work ranging from the lightest sheet metal welding to heavy welding work.

The Type W-106 blowpipe is similar in design to the Type W-105, but is smaller. It is supplied with five sizes of tips, Nos. 3 to 7, inclusive. It is particularly suitable for general light welding, bronze-welding and soldering.

Elwell-Parker 25-Ton Die-Handling Tiering Truck

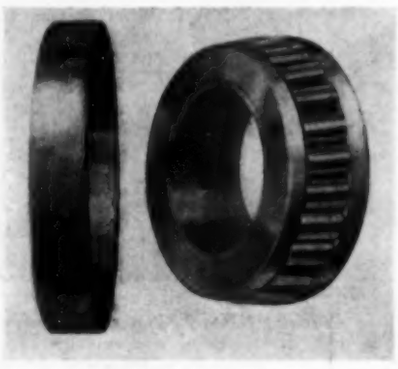
For transporting automobile body dies from storage to the presses, the Elwell-Parker Electric Company, Cleveland, Ohio, has developed an electric tiering truck. Some of these dies weigh as much as 25 tons; the one on the truck illustrated weighing 15 tons. The truck itself weighs approximately 13,000 lb. and is powered by a gas-electric unit. The drive wheel tires are 22x6 in., while each front wheel carries two 15x5 in. solid-rubber tires. The front axle accommodates its wheels to uneven runways. The platform of this truck is built of heavy structural and bent plate members, but it has no support at the forward end, and thus is a cantilever-type load platform. The load is carried on two L-shaped steel arms. These arms travel up and down the vertical members of the frame, so that the die upon delivery at the press may be raised to the level of the receiving table by means of a powerful electric winch. This electric winch performs a dual function. In addition to elevating the load, it operates a cable drum that causes the die to be moved towards the front end of the platform and slid onto the press platen. To remove the die from the press, the two winch cable hooks are used to drag the die onto the truck platform.

Elwell-Parker Die-Handling Tiering Truck transporting a 15-ton body die from storage

Tyson Cageless Tapered Roller Bearings

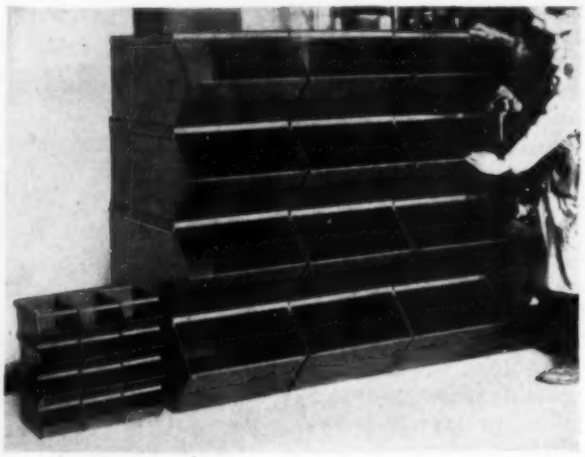
Cageless tapered roller bearings interchangeable with conventional ball and tapered roller bearings have been placed on the market by the Tyson Roller Bearing Corporation, Massillon, Ohio. Positive roll alignment is attained by the use of a double-ribbed backplate at the big end of the rolls, thus doing away with the necessity for a cage. The shoulder of each roll gets a bearing on the inside rib of the backplate, as in other tapered roller bearings, but it also gets an additional bearing on the outside rib. Thus, with double contact on the thrust end of each roll, positive alignment, both longitudinally and vertically, is secured Pintles at both ends of the rolls, extending into the annular grooves in the backplate and the closing ring, hold the rolls in place when the cup is removed. Omission of the cage from the bearing leaves room for the insertion of from 20 to 50 per cent more rolls.

The double backplate contact of the rolls, plus a raceway filled with tapered rolls, means that no roll can get out of place or overlap when operating at high speed. Positive line contact of rolls on the cone is inherent. The bearings are made in all S.A.E. sizes.



"Stackbin" Sectional Bins

The Stackbin Corporation, Pearl & Rice Sts., Providence, R. I., has taken over the manufacture and sale of the entire line of nesting bins from the Simplex Tool Company, Woonsocket, R. I. These products will in future be known as "Stackbins." They were described previously on



"Stackbin" Nesting Bins and Bin Sections, which were formerly known by the trade name of "Simplex." The nesting bins are for bench use and the bin sections for stockrooms

page 379, Vol. 74. The line at present comprises individual nesting bins and sectional-type nesting bins. They are not bolted together, and can be easily rearranged if desired.

Stackbin nesting bins are made to reduce material handling costs. They save time in the assembling of small parts; reduce handling time on production work; and by eliminating counting in inventory work will save time in the stock room, being weighed with the contents to get the quantity.

The nesting bins are made in four sizes. The first is 4 in. high, 5½ in. wide, and 12 in. long. The last is 9½ in. high, 12 in. wide, and 20 in. long. The bin sections are also made in four sizes, and are sub-divided into from three to six compartments. The largest size measures 37 in. wide, 20 in. deep, and 9½ in. high.

EQUIPMENT ADAPTATIONS

RECENTLY DEVELOPED BY THE MAKERS

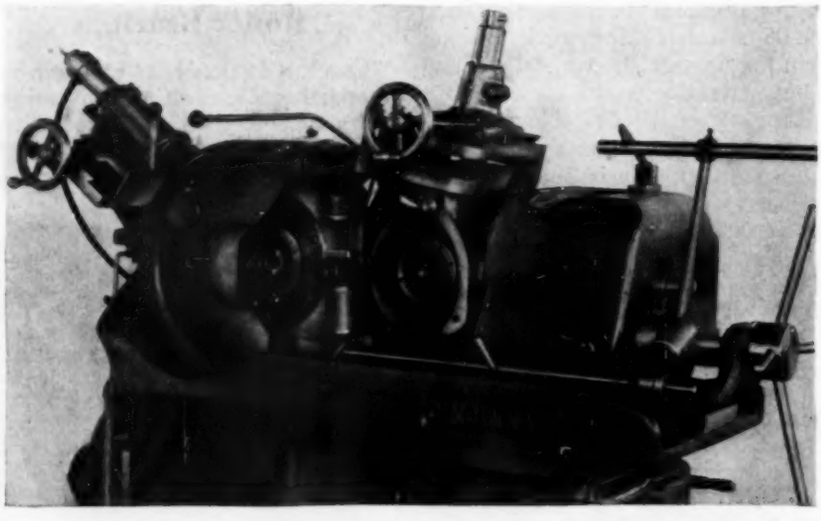
Centerless Grinding of Steering Knuckles with Duplex Wheels

Two diameters of dynamically and statically unbalanced steering knuckle shafts are ground simultaneously on the Cincinnati No. 2 centerless grinder, using a double grinding wheel mount with the wheels profiled to grind both diameters in one cut by the in-feed method. This machine has been built by the Cincinnati Grinders, Inc., Cincinnati, Ohio.

The steering knuckles are placed on the special stepped work-support blade and are held firmly in position by an overhead equalizing pressure shoe. To overcome the unbalanced condition due to the heavy arm, a counterweight is used during the grinding operation.

The operating mechanism for performing this job is located on the rear portion of the work rest and is designed so that the overshoe is automatically lowered and raised on each stroke of the in-feed lever to clamp and feed the work.

A spindle reciprocating attachment, with a hand lever extending to the operator's side of the machine, is supplied for advancing the grinding wheel forward a slight amount to clean up the shoulder and fillet. Stock removal is 0.010 in. on both diameters with two 20x1½x12 in. wheels. Production of 90 finish ground pieces per hour is obtained and limits for size are held within 0.0005 in., for roundness within 0.0003 in., and for straightness within 0.0003 in.

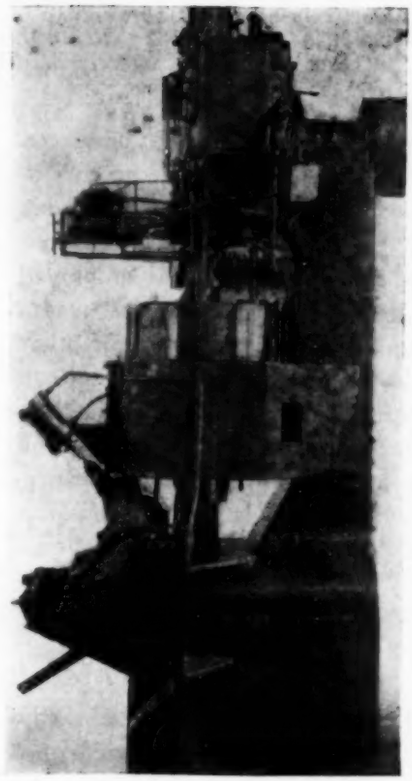


Cincinnati No. 2 Centerless Grinder arranged to grind simultaneously the two diameters of dynamically and statically unbalanced steering knuckle shafts to 0.0005 in. of size at the rate of 90 pieces per hour

Davis & Thompson Upright Machine with Indexing Turret for Cylinder Blocks

Six operations on the distributor hole of an automobile cylinder block are performed on the upright machine illustrated. This machine, developed by Davis & Thompson Company, 57th Ave. & Mitchell St., Milwaukee, Wis., has a vertical indexing head, operated by a cylinder connected to an Oilgear pump. The head has six spindles mounted in Timken bearings. The speed of the spindles can be changed for any operation. The pump gives rapid traverse to the work and a separate feed in relation to the cutters used.

The cylinder block is locked in place by air clamping means. An air cylinder is placed below the table as well as one on top. Boring bars are piloted in a rotating ball-bearing guide in the table. After the operator places a cylinder in this machine, he throws



Davis & Thompson Upright Machine with indexing turret for cylinder blocks

the lever at the left to perform all six operations before stopping the unit.

One of the features of this machine is an indexing mechanism guided at the front end of the machine by a yoke passing around the indexing head. The guide is a block hardened and ground to insure accurate indexing. The machine drills two different size holes, spot faces two different sizes, and fly cuts and reams two different sizes.

PATENTS

APRIL 7, 1931

Metal-Working Machinery

Bit-Forging Machine. Carl J. Angstrom, Pittsburgh, Pa., assigned to The Martin Hardsocg Co. Patent 1,799,151.

Machine-Tool Transmission and Control. Joseph B. Armitage, Milwaukee, Wis., assigned to Kearney & Trecker Corporation. Patent 1,799,272.

Combined Boring and Turning Machine. William H. Millspaugh, Sandusky, Ohio, assigned to The Paper & Textile Machinery Co. Patent 1,799,384.

Gear-Cutting Machine. Ernest L. Fickett, Fitchburg, Mass., assigned to Scurlock Gear Corporation. Patent 1,799,460.

Grinding Machine. Henry H. Yerk and William J. Baumberger, Davenport, Iowa, assigned to Micro Machine Co. Patent 1,799,491.

Machine Tool. Max E. Lang and Theodore Norton, Cleveland Heights, Ohio, assigned to The Warner & Swasey Co. Patent 1,799,518.

Drilling Machine and Machine for Other Purposes. Ralph M. Lovejoy, Boston, Mass. Patents 1,799,594 and 1,799,595.

Machine for Manufacture of Rotary Cutting Tools. Alois Tscherne, Rorschach, Switzerland. Patent 1,799,608.

Swage Shaper. Dewey E. Gommel, Indianapolis, Ind., assigned to E. C. Atkins & Co. Patent 1,799,623.

Pressure Welding Machine. Frank J. Brown, Washington, Pa., assigned to National Wrought Iron Annealing Box Co. Patent 1,799,724.

Control for Internal Grinders. Clifford T. Raule, Brookline, Pa. Patent 1,799,763.

Multiple Drill. George D. Haskell, Springfield, Mass., assigned to Baush Machine Tool Co. Patent 1,799,812.

Gear-Cutting Machine. Allen H. Candee and Magnus H. Johanson, Rochester, N. Y., assigned to Gleason Works. Patent 1,799,883.

Press Cut-Off. Carl A. Braun, Toledo, Ohio, assigned to Steel and Tubes, Incorporated. Patent 1,800,005.

Tools and Attachments

Tailstock Attachment for Lathes. Louis C. Reis, Duluth, Minn. Patent 1,799,179.

Feed-Screw Limit Gage for Lathes. Charles E. Moore, San Francisco, Calif. Patent 1,799,311.

Over-Arm Clamp for Machine Tools. Joseph B. Armitage, Milwaukee, Wis., assigned to Kearney & Trecker Corporation. Patent 1,799,493.

Precision Measuring Device. John B. Elfring and Carl G. Schiele, Cincinnati, Ohio, assigned to Cincinnati Grinders, Incorporated. Patent 1,799,739.

Tool Holder for Double-Acting Lathes. Frederick S. Floeter, Saginaw, Mich., assigned to Wickes Bros. Patent 1,799,893.

Furnaces

Material Conveyor for Furnaces. Frank T. Cope, Salem, Ohio, assigned to The Electric Furnace Co. Patent 1,799,956.

Apparatus for Heat-Treatment. Frank T. Cope and Arthur H. Vaughan, Salem, Ohio, assigned to The Electric Furnace Co. Patent 1,799,957.

Continuous Heating Furnace. Samuel E. Diescher, Pittsburgh, Pa., assigned to S. Diescher & Sons. Patent 1,800,170.

Processes

Method of Cutting Metal with a Cutting Gas. Clarence J. Coberly, Los Angeles, Calif., assigned to Kobe, Incorporated. Patent 1,799,613.

Method of Producing Slots. Clarence J. Coberly, Los Angeles, Calif., assigned to Kobe, Incorporated. Patent 1,799,614.

Apparatus for Treating Metal-Coated Articles to Insure Uniformity of Coating. John W. Moon, Butler, Pa., assigned to Fretz-Moon Tube Co., Patent 1,799,760.

Process for Heat-Treatment of Metal Articles. Walter Beck, Frankfort-on-the-Main, Germany, assigned to Deutsche Gold & Silber Scheideanstalt vormals Roessler, Frankfort-on-the-Main, Germany. Patent 1,799,945.

TRADE PUBLICATIONS

GAGES. The U. S. Department of Commerce, Bureau of Standards, has issued Research Paper No. 276 entited "The Resistance of Chromium-Plated Gages to Wear." Gages given a bright deposit, heated to 300 deg. C. for 24 hours, and lapped showed the greatest resistance to wear. Copies are available from the Superintendent of Documents, Washington, D. C., for 10 cents.

GRINDERS. The Blanchard Machine Co., 64 State St., Cambridge, Mass., has issued a general catalog on the Nos. 16, 10, 16A, 16-A2 and 27R vertical surface grinders. Complete specifications are given for these types.

INSTRUMENTS. The Brown Instrument Co., Philadelphia, Pa., has issued Catalog No. 8008 giving latest data on control instruments for temperatures, pressures, flows, liquid levels, and other process operating factors. The book contains 48 pages and 46 illustrations.

OPTICAL COINCIDENCE GAGE. The U. S. Department of Commerce, Bureau of Standards, has issued Research Paper No. 272 entitled "An Optical Coincidence Gage." This gage permits measurements in a direction normal to the surface viewed and without mechanical contact with the work. The paper is available from the Superintendent of Documents, Washington, D. C. for $0.10.

PORCELAIN GLAZES. The University of Illinois, Engineering Experiment Station, Urbana, Ill., has published bulletin No. 225 entitled "The Miscrostructure of Some Porcelain Glazes," taking up the influence of the microstructure upon the development of the various types of glazes. Copies are free.

ROLLER CHAIN. The Diamond Chain & Manufacturing Co., Indianapolis, Ind., has issued a new booklet, "Simplifying and Improving Machine Design," which discusses the eight classes of transmission problems where roller chain drives can be applied.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

New York, April 16, 1931

VOL. 74 *No.* 16

Reconstruction

BUSINESS recovery is in the making. How to hasten it and how to hold it when it is attained are the vital questions at this juncture. Our outstanding need is sound leadership, a need made all the more evident by the American tendency to move too fast and to think too superficially. Too many untrained men, selfish men, shallow men, too many gamblers head American business institutions.

Poise, experience, sincerity are crying needs for today's — and tomorrow's — executives. That must mean more careful selection of personnel, more careful training, and a return to comparative valuation of character and brains. Literally, these new men must be maintenance men, business maintenance men if you will. Just as shop maintenance men search for flaws in equipment, anticipate difficulties, and strengthen the weak places before the machine breaks down, so must business executives delve continuously into their organizations, repairing, reconstructing, strengthening. This is one of the rarest things in business management today. We build an organization, then shift our attention to outside interests, sales totals, quotas, dividends — letting the internal organization shift for itself. And that, eventually, leads to a jammed gearbox when the lights turn green.

New Machines—More Employment

IN ENGLAND, as well as in the United States, industrial executives are finding it necessary to refute again and again the time-worn fallacy that improved machinery and more scientific methods tend to decrease employment.

A case in point is cited by C. R. F. Englebach, Works Director of the Austin Company, Ltd., who recently wrote *The Automobile Engineer* (London) that his company by the expenditure of £1,143,500 in the plant over a five-year period (1925-1930) reduced the number of workers *per car* from 63 to 13, but the total number employed was *increased* from 7,486 to 12,200. At the same time the retail price of the product was reduced 47 per cent.

This executive might have added that hundreds of workers outside his own plant were given employment in building the new machinery which his company installed. Moreover, workers numbered in the hundreds of thousands are today employed in servicing cars, refining and selling fuel, manufacturing tires and doing a great variety of other work of a kind almost unknown a generation ago largely because the Austin and other companies in England, in the United States, in France, and in Germany have been enabled to build inexpensive cars that never would have been possible without constantly improved methods and machinery.

It Won't Work

BEWARE the benighted individual who knows positively that a knew device or a new machine will not work because it apparently violates the old rules of thumb that guide his thinking, what little he does. And be doubly cautious if he refuses to accept a visual demonstration.

If you are a salesman and he is a buyer your only hope is that he will pass on, be fired, or retire. The best sales talk in the world will leave him as unmoved as the Sphinx.

If you are his employer and he holds a position of any responsibility get rid of him as painlessly as possible the moment you discover his weakness. He may do for you what one of his brother has just done for his employer.

A new device was presented to this man by the inventor. Apparently the device defied all natural laws. Even the inventor did not know why it worked. Our friend refused absolutely to witness a demonstration. He said he was certain that the device was wrong in principle and that no demonstration, no matter how successful, would convince him that it would work.

The inventor gave him up, went to his company's principal competitor, was given a hearing and then a contract on a royalty basis. The chances are that the competitor has acquired a product it can make and sell at a profit.

Once more—beware of the man who "knows it won't work." He is a liability.

IV—Maintenance of World Business

A—*Support co-operative studies and formulation of world policies among business interests through international business organizations on such subjects as—*

(1) World tariffs
(2) Trade discriminations
(3) International movement of capital
(4) War debts and reparations

IF there is any American business man who is not wide awake to the vital importance of this plank in the McGraw-Hill platform he should read "Business Adrift," by Dean Donham of the Harvard Business School, with particular attention to the sections on foreign trade. If that book does not arouse him to the perils into which our lack of business planning is dragging us, he is beyond hope.

What follows is an attempt to paraphrase Dean Donham's logical analysis of the international trade situation and its effect upon American domestic economy.

Many of our industries have been overbuilt because the old economic doctrine that competition is the life of trade has been written into our statutes, and carried over from a pioneering period, where it was a logical policy, to the present chaotic era where science and management are introducing radical changes more rapidly than they can be provided for. The obvious remedy when home markets fail is to seek an outlet in world markets. But that means open competition with the industrial nations of Western Europe. They are not so thoroughly mechanized as we are but their wage and living standards are so much lower that in the long run we shall have to descend to their level if we hope to secure our share of international trade in those commodities in which we have not a commanding position, such as machinery.

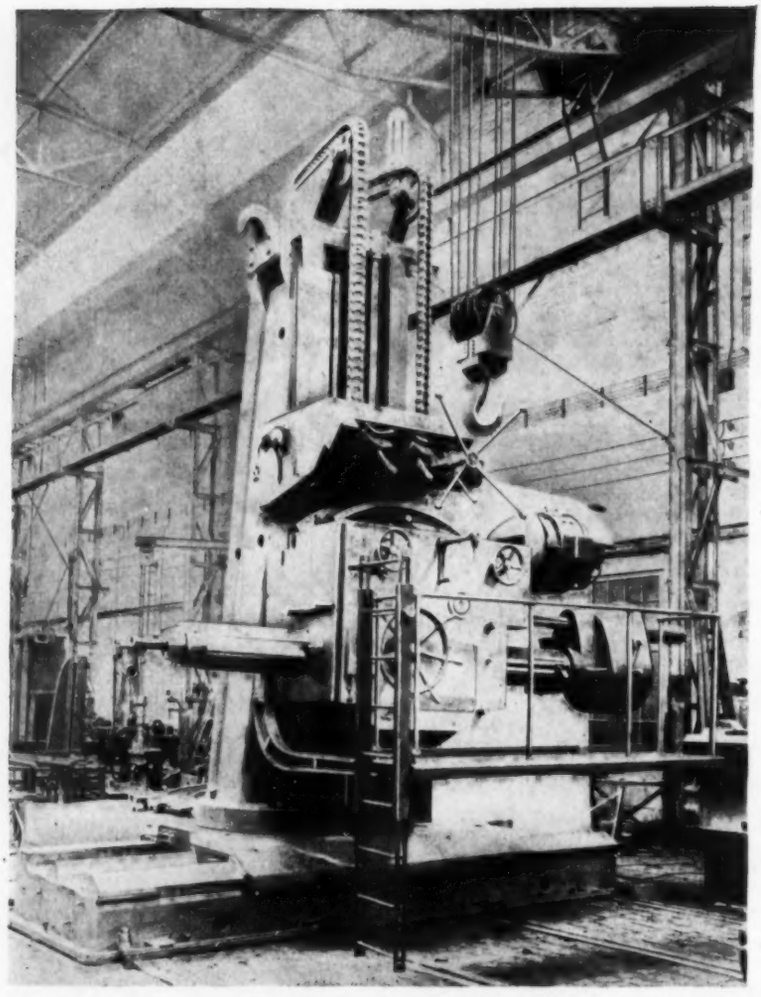
We have built up our standards behind tariff walls. They are doing likewise and will continue to do so. Our competition, then, will not be within their borders, but in the open markets of other parts of the world. And in those markets we shall meet increasingly severe competition from England and Germany. We can probably ruin those two countries, but if we do what will happen?

Simply this—if they collapse we lose two of our best markets, and when they do the chances are that they will swing from capitalism to communism, and with them the rest of Europe. Can we hope to continue as the only capitalistic nation in the world? Look at Russian competition in the wheat market and find the answer.

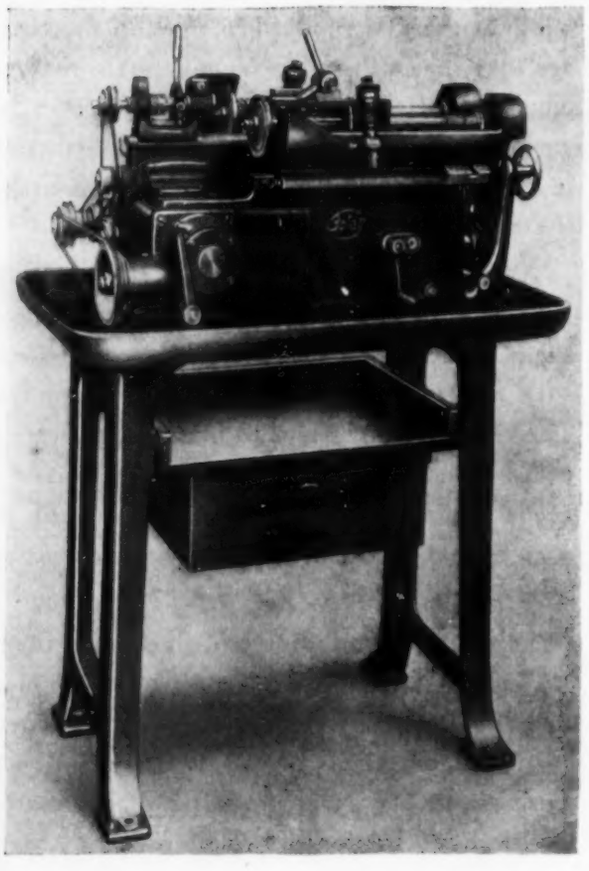
As to war debts let us forget the sentimental reasons for forgiving them; there is no logic in them whatever. But we should forgive them to save England and Germany from ruin, on condition that they take steps to limit ruinous competition between themselves. "If Soviet Russia succeeds for a generation, the restoration of these nations will be essential to the maintenance of a Western civilization."

Space is all too short to give more than an inkling of the implications of Dean Donham's analysis, but surely enough has been presented to prove the soundness of the recommendation that business should support studies of international political and commercial relations.

Machine Tools at the Leipzig Fair—II



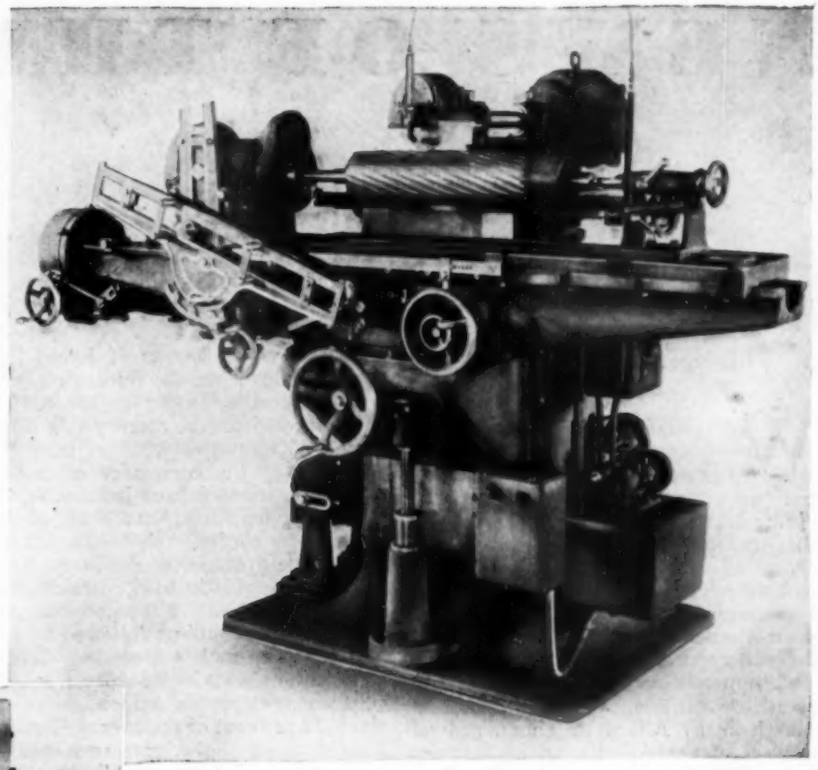
Portable horizontal boring and milling machine shown by Collet & Engelhard. All control elements are centralized, and include one-hand slow-motion and quick-motion and push-button controls. This model has a 6¼-in. diameter octagonal boring bar as a guide for the inner 2¾-in. diameter drilling spindle proper. The unit has a movable swiveling housing and V-shaped guides on bed and housing. Lubrication is by a circulating system



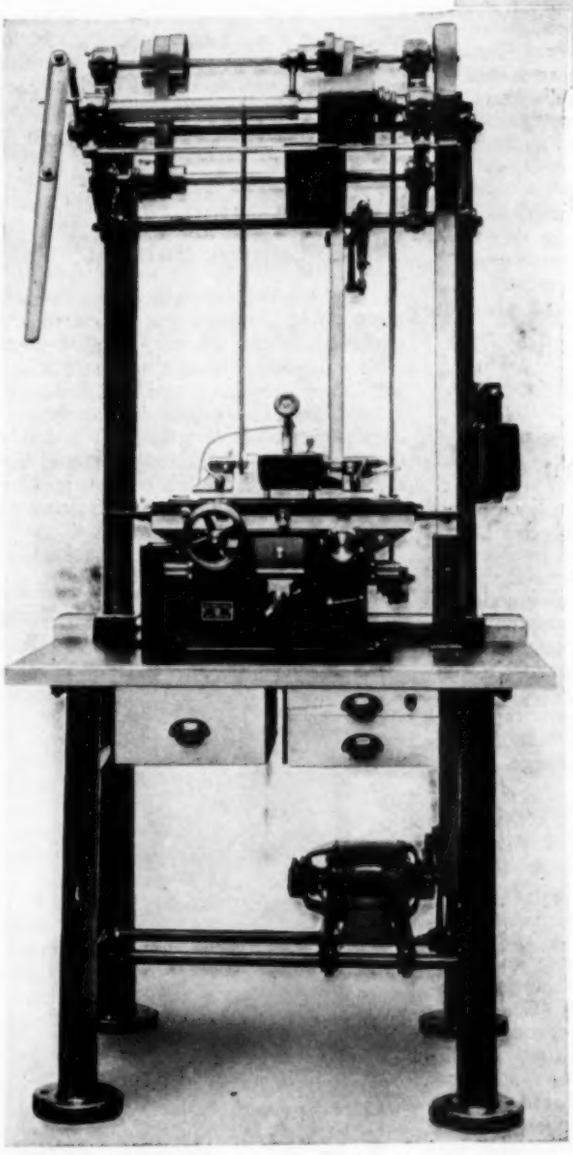
Chiefly used for grinding and polishing small shafts and pinions for watches and meters, this Bley & Cie unit is especially well adapted for cylindrical and conical work. Lapping may be followed by buffing without reclamping, and two journals of different diameters may be finished, also without reclamping. Other machines have automatic feeds, single-lever controls, and internal grinding attachments

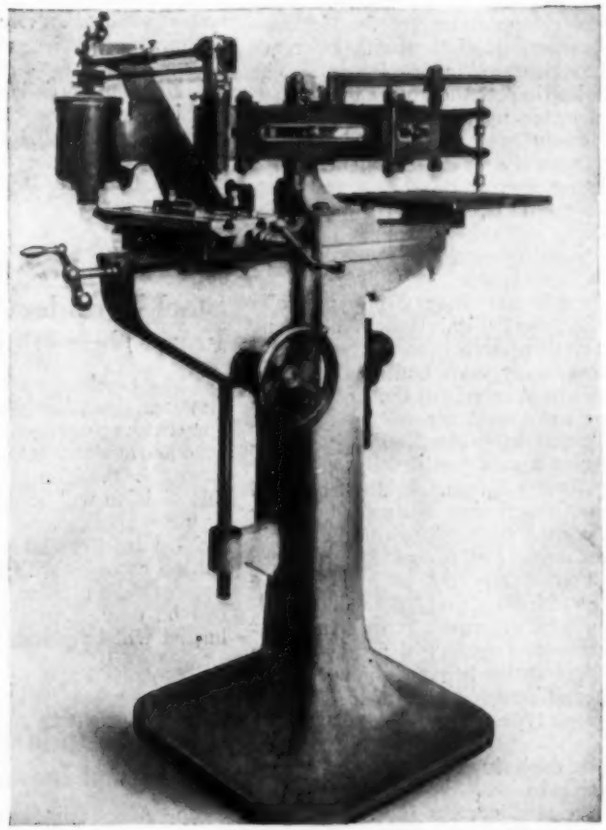
An electric right-angle hand drill shown by Bader & Halbig. The housing is insulating, requiring no grounding, and the unit weighs 34 oz. for ⅜-in. capacity, and 59 oz. for ½-in. capacity

Full-automatic tool and cutter grinder, shown by Grossenhainer Webstuhl und Maschinen-Fabrik A.G. Capacities are 11¾ and 23½ in. in length and 7⅞ and 11¾ in. in diameter. Indexing is done by means of a dividing head with stage gears, and backing-off of tools is accomplished by a friction drum device with stage gears. A differential grinding pressure regulating device compensates for wheel wear. All sorts of tools may be handled by using attachments



Small precision circular grinding machine with collet headstock and arrangement for wet grinding, shown by Beling & Lubke. It has an automatic feed and is furnished with 2 5/32 or 3 1/32-in. height of centers. Single lever controls and internal grinding attachments may be fitted, and conical work may be handled





Engraving and profiling machine suited for light or heavy engraving and for light milling work, shown by Franz Kuhlmann. The engraving spindle is belt driven from a unit motor coupled to the pantograph system. Both pantograph and motor bracket are of light alloy. A special engraving head with a guide bearing is provided for extremely precise work

NEWS OF THE WEEK

Trainmen Petition Railroads For Mechanical Equipment

PAUL WOOTON
Washington Correspondent

WASHINGTON, D. C., April 12—Locomotive firemen and enginemen are presenting their testimony in support of the petition filed by the brotherhoods several months ago that railroads should be required to equip all locomotives with automatic stokers. The hearings before Special Examiner J. L. Rogers, of the Interstate Commerce Commission, are expected to continue for several weeks.

Examiner Rogers overruled a motion presented at the opening of the hearing March 27 by Alfred P. Thom, general counsel of the Association of Railway Executives, for dismissal of the brotherhoods' petition on the ground that under the Boiler Inspection Act the Commission has no jurisdiction with reference to mechanical stoking equipment. The brotherhoods rest their plea for a mandatory order upon the claim that installation of mechanical stokers will promote safety in train operation by permitting firemen to devote more attention to observance of signals and crossings, and other duties. The fireman is equally responsible with the engineer in this respect.

The railroads have been gradually installing mechanical stokers on many of the more powerful locomotives over a period of many years and it is expected that they will submit to the Commission when they open their testimony about May 1 that such installations are proceeding at a rate justified by operating and traffic conditions. It is not believed that the Commission will enter an order requiring the railroads to equip all locomotives with mechanical firing equipment immediately but may follow the same practice as that adopted in connection with automatic train control installations and require the railroads to install automatic firing equipment on a certain minimum number of locomotives of various types each year.

While deploring wage cuts as a matter of principle, official Washington takes the position that if there must be reductions, they should be made scientifically. A reduction in wages in proportion to the decline in the cost of living is regarded as scientific. Some 116 concerns whose names are not divulged already have entered into an agreement with their employees whereby wages are adjusted to a sliding scale determined by the cost of living as reported by the Bureau of Labor Statistics. Thus since the Bureau reported a 7 per cent reduction in the cost of living throughout the country as a whole during 1930, wages were adjusted accordingly by the companies concerned.

Of the various factors influencing the cost of living, food has declined the most. The statistics show that 38 per cent of the average income is spent for food. During 1930 food costs declined 13 per cent. Next in the percentage of decline comes clothing, followed by furniture, power and fuel costs, and rent. It has been found, incidentally, that miscellaneous expenses, which constitute about 20 per cent of the average income, have shown a slight increase instead of a decrease. Under miscellaneous expenses such items as street car fares, cost of medical service, and amusements are included.

Half a billion dollars worth of orders will be turned loose within a very brief period after prices show that they really have begun their upward march, it is estimated at the Department of Commerce.

Steel Founders Form New Division

The Steel Founders' Society of America, Inc., has established a Development Engineering Department, with headquarters at 932 Graybar Bldg., New York, N. Y. The principal function of this division will be to develop new uses or new applications for cast steel, as well as to serve all industry in a consulting capacity with reference to metal construction problems where cast steel can be used. An engineer and metallurgist will be placed in charge.

Three Standards Approved by A.S.A.

The American Standards Association has approved two new American Tentative Standards, Specifications for Refined Wrought-Iron Bars (G12-1931), and Specifications for Wrought-Iron Plates (G13-1931), submitted by the A.S.T.M. as sponsor. Both specifications were originally approved in 1923. They have now been revised by the addition of a definition for wrought iron and the elimination of the reference to puddling.

A new American Tentative Standard, Symbols for Heat and Thermodynamics (Z10c-1931), has also been approved. This standard is the result of extensive work by the sub-committee which cooperated with the international organization sponsoring standardization of projects of such symbols.

Research Exhibit At Mechanics Meeting

The First National Meeting of the Applied Mechanics Division of the A.S.M.E., to be held at Purdue University, June 15, 16 and 17, will include an interesting exhibit of new research apparatus and devices in the field of Applied Mechanics. J. M. Lessells, secretary of the Applied Mechanics Division, Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., is in charge of the arrangements for the exhibit. It will be housed in the Electrical Engineering Building at Purdue.

Administration To Be College Subject

The College of Engineering, Cornell University, is planning a course in administrative engineering, in agreement with a recommendation of the Society for the Promotion of Engineering Education. The course is proposed to be five years in length, with a fairly fixed selection of Arts subjects and the essentials of the M. E. course, leading to the degree of Bachelor of Science in Administrative Engineering.

PROPOSED Revision No. 591 of the Federal Specification for Tracing Cloth has been submitted to industry.

ARTHUR NUTT
Chief Engineer, Wright Aeronautical Corporation, who presented a paper at the S.A.E. Aeronautic Meeting

European Metal-Working Repercussions of the German-Austrian Accord

Francis M. Mansfield
Paris, France

OBSERVATION of the Austro-German trade treaty, affecting 90 per cent of all commodity transactions on the basis of bi-lateral exchanges free of all customs levies, suggests that Great Britain and France have been hardest hit. At any rate, they are due for a realization of business upheaval such as was never before known if the theory and practice spreads to other Central European countries.

Though their present attitude is not confirmed, Roumania and Yugoslavia are believed to have been talking over a similar accord with Austria for some years past. That the reaction will make itself felt in the United States is not at all impossible, though ill effects will be less apparent on the balance sheet.

Recent conferences of the League of Nations, urging concerted economic action among European states, brought forth a tentative proposal from Great Britain that the agricultural states of Central Europe might exchange their commodities for British machinery and textiles on a free-trade basis or under some sort of a regime of a preferential tariff. The differences between the German-Austrian accord and the proposition recently put forth by Great Britain is not so very great, unless one admits that an offer of goods is by no means the same thing as a sale.

The following figures show the German and Austrian position in the game as far as it has gone. The figures are recent, being quoted from a report compiled for the Concerted Economic Action Conference held at the League of Nations at Geneva in 1930.

Germany's sales of machinery and parts to Austria were, in 1929, valued at 45,200,000 marks. Of electro-technical apparatus the value was 16,200,000 marks. "Other goods in iron and steel," including tools, cutlery etc., were valued at 25,100,000 marks. Austria's exports to Germany were as follows: Iron and steel manufactured goods, 23,463,000 schillings; automobiles and motors, 20,400,000 schillings; machinery and appliances, 11,793,000 schillings.

Great Britain's machinery sales to Germany were valued at £1,755,000; iron and steel and articles thereof, £1,063,000. To Austria, Great Britain sent automobiles, motorcycles, and parts to the value of £201,000 and machinery £86,000. Germany's sales to Great Britain totaled 58,900,000 marks for machinery and tools; 111,700,000 marks for "other objects of metal"; 38,000,000 marks for semi-finished steel products. Austria's export trade to Great Britain for machinery and apparatus was valued at 4,259,000 schillings; for "other objects of metal," 3,418,000 schillings.

The voice of France is heard the loudest in emphatic protest in that her exports of automobiles to Austria exceed 5,000,000 francs in value per annum, to say nothing of the product of her textile mills to the value of 79,000,000 francs. Equivalent German exports to Austria already run up to the value of 225,600,000 francs per annum. At the same time France buys the manufactured metal products of Austria to the extent of 1,236,000 schillings, which naturally henceforth she will try to do without.

French exports of machinery and parts to Germany were valued at 176,000,000 francs, in 1929, with "tools and objects of metal" totalling 219,000,000 francs more. France buys machinery, parts and boilers of Germany to the value of 78,700,000 marks and electro-technical equipment for 22,600,000 marks. The balance in favor of Germany is $8,000,000. It may be readily conceived that at equal prices, France may well be thought willing to trade elsewhere from now on, rather than to encourage the growth of Central-European trade exchanges on any basis and by any means whatever which will make it possible for those countries to scale the "most favored nation" barrier.

Most German and Austrian commercial accords entered into with other countries since the war are denouncable with three and six months pre-advice.

Igor Sikorsky
who presents a paper this week at the S.A.E. Aeronautic Meeting

Management Short Course Planned by Penn State

The sixteenth short course in management problems, given for ten days annually to visiting executives by the industrial engineering and engineering extension departments of the Pennsylvania State College, will be held this year from June 10 to 18. Professors C. E. Bullinger, J. O. Keller, and S. B. Colgate will be in charge of the work again this year. The announced purpose of the course is the stressing of the sound fundamentals of production management developed during the past decade, and includes work in industrial relations and management, micro-motion principles, factory planning, production control, elements and sources of cost, executive ability, and cost accounting.

BUSINESS ITEMS

The Allegheny Steel Co. will henceforth use the trade name "Allegheny" in connection with all its products, designating the entire group of chromium and chromium-nickel alloys as "Allegheny Alloys." The trade name "Ascoloy" will be dropped.

The Ludlow Valve Manufacturing Co., Troy, N. Y., has formed the Canadian Ludlow Valve Manufacturing Co., Ltd., with registered offices in Montreal, and with Drummond, McCall & Co., Montreal, as sales agents for the Dominion. Ludlow valves and hydrants will be manufactured in Canada, and while the Canadian company's operations will be under the direction of the parent company, the capital involved, labor employed, and material will be Canadian.

The Radiator Specialty Co., Charlotte, N. C., has arranged through the Toronto Industrial Commission to establish a factory in Toronto, Ont., for the manufacture of solder-seal products for the automotive and plumbing trades. The company will be known as the Radiator Specialty Co. of Canada.

The name of Johnson Gear Co., Berkeley, Calif., founded in 1905, has been changed to the Johnson Gear Manufacturing Co., Ltd. The change in name was made to more accurately describe the expanded activities of the organization.

F. H. Hopkins & Co., Ltd., Montreal and Toronto, has been appointed agent for Ontario and Quebec for the Clyde Iron Works, Duluth, Minn., and the Ohio Locomotive Crane Co., Bucyrus.

The Shepard Niles Crane & Hoist Corporation has appointed the Elliott Electric Co., 2178-2186 West 25th St., Cleveland, Ohio, and A. G. Acker, 1409 Keystone Bldg., Pittsburgh, Pa., as local representatives for Sprague electric hoists and winches.

The Meriam Co., 1955 West 112th St., Cleveland, has appointed Mayer & Oswald, 332 South LaSalle St., Chicago, as Chicago district sales representatives.

Bay City (Mich.) Shovels, Inc., has completed arrangements for the manufacture of its complete line in Canada by the John Inglis Co. Ltd., Toronto.

The Polymet Co., Winsted, Conn., is installing new wire-drawing machinery and will resume operations soon.

The Acme Manufacturing Co. has begun operations in Bridgeport, Conn.

PERSONALS

Hugh Benet, Works Manager of the Worthington Pump & Machinery Co., Holyoke, has been elected president of the Western Massachusetts branch of the National Metal Trades Association, succeeding Roe S. Clark of the Package Machinery Co. Other officers are: First vice-president, Edward L. Stoughton, Wico Electric Co.; second vice-president, G. J. Lang, United American Bosch Co.; treasurer, Charles R. Hastings, Hastings & Schoen; executive committee, Charles B. Fitts, Standard Electric Time Co.; John C. Beggs, Bemis & Call Co.; John P. Fogarty, Westfield Manufacturing Co.; Howard W. Hosford, Norwood Engineering Co.

William L. Brown, 1600 Arch St., Philadelphia, has been appointed special Philadelphia representative for the Logan Iron & Steel Co., Burnham, Pa.

Ward C. Castle, Executive Vice-President of the National Bank of the Republic, Chicago, has been elected a director of the Kellogg Switchboard & Supply Co., Chicago.

George Chismark, of Tarentum, Pa., has been elected secretary-treasurer of the Springdale (Pa.) Foundry Co., Inc., which has plans in progress for construction of a modern foundry there.

Arnold Stuart Durrant, for the past six years vice-president in charge of commercial relations of the International General Electric Co., Inc., retired from active service recently and was made an honorary vice-president.

Alfred F. Howe, who retired five years ago as vice-president and general sales manager of the Borden Co., Warren, Ohio, pipe-tool manufacturer, has become western sales manager, with offices at 717 Calmar Ave., Oakland, Calif.

Mark F. Hoeper has been appointed general manager of the Jenkins Machine Co., Sheboygan Falls, Wis.

Irving L. Jones, formerly treasurer of the International Heater Co., Utica, N. Y., has been elected president to succeed the late Frank E. Wheeler. Beecher M. Crouse has been chosen a director to fill Mr. Wheeler's place on the board. Other officers include Mary J. Beggs, comptroller; Robert L. Griffiths, secretary-treasurer; and Harry A. Chester, assistant secretary and treasurer.

Roy J. Giddings, formerly vice-president and sales manager of the Badger Wire & Iron Works, Milwaukee, has joined the newly organized Wisconsin Art Bronze & Iron Co., Milwaukee, in a similar capacity.

Joseph R. Kraus, Vice-Chairman of the Union Trust Co., Cleveland, Ohio, has been elected a director of Thompson Products, Inc., Cleveland, manufacturer of automotive parts.

Benjamin G. Harmon has been elected vice-president of the Gas Machinery Co., Cleveland, and will be in charge of the newly organized furnace engineering division.

J. Frank McKenna, a director of Heyl & Patterson, Inc., Pittsburgh, has been named president to succeed the late W. J. Patterson. He is also treasurer and director of the Hanlon-Gregory Galvanizing Co., and the Tri-Lok Co., both of Pittsburgh. J. Pierre Vogel, identified with Heyl & Patterson for a number of years, has been appointed vice-president and general manager.

Vincent E. McMullen, Works Manager of the Indianapolis plant of Fairbanks, Morse & Co., was elected president of the Indianapolis branch, National Metal Trades Association, at the twenty-fifth annual dinner at the Columbia Club. He succeeds George P. Torrence, branch plant manager in Indianapolis of the Link Belt Co., who had been president two years. Other officers are Ferdinand Barnickel, President of the Indianapolis Drop Forging Co., vice-president, and J. M. Caswell, Secretary of the Diamond Chain & Manufacturing Co., treasurer. Mr. Torrence was named a member of the executive committee for a term of two years.

W. W. Nichols, Vice-President and Mechanical Engineer of D. P. Brown & Co., 1440 Park Place, Detroit, Mich., and Prof. F. G. Novy were decorated with the Order of the White Lion by Dr. Ferdinand Veverka, Czechoslovak Minister to Washington, on April 13. Mr. Nichols has done considerable development work on belt drives and is an active committee member in both the A.S.M.E. and the S.A.E.

A. H. Mowry has been appointed manager of sales of the electrical and wire rope department at New York of the American Steel & Wire Co., Chicago, to succeed John May, recently promoted.

Karl Peterson, President of the Crescent Tool Co., Jamestown, N. Y., is seriously ill there.

Harry W. Petty, formerly Cleveland district sales manager for the American Steel Foundries, New York, has joined the sales department of the Union Steel Casting Co., Pittsburgh.

Joseph A. Piacitelli has opened an office as a consulting industrial engineer at 11 West 42nd St., New York, N. Y. He will specialize in management problems, particularly in motion study and financial incentives.

Grant Pierce, formerly president of the National Radiator Co., and the New England manager for the American Radiator Co., New York, has been made vice-president and sales manager of H. S. Smith Co., Westfield, Mass.

Wm. G. Praed has been appointed radiograph engineer in charge of the new commercial X-ray laboratory at 2416 West 15th Place, Chicago, Ill., of the Claud S. Gordon Co., 708-714 West Madison St., Chicago.

O. R. Rabel, formerly secretary-treasurer of the Star Machinery Co., Seattle, Wash., has been elected president to succeed the late Christian Rabel. V. E. Rabel, Vice-President, was made treasurer, and I. B. Rabel was made secretary.

Edward O. Otis, Jr., Merchandising Adviser of the Associated Industries of Massachusetts, and C. W. Whitney of San Francisco, Executive Secretary of the Purchasing Agents' Association of Northern California, has been appointed Massachusetts and California representatives of the American Standards Association.

F. J. Schlink, Assistant Secretary, American Standards Association, has resigned to become full-time technical director of Consumers' Research, Inc., an association of ultimate consumers. The American interest in the "preferred numbers" system was a result of the work which Mr. Schlink did in translating foreign information on the subject. He was also in charge of the A.S.A. Information Service and editor of the A.S.A. "Bulletin."

M. G. Sternberg has been appointed operating manager of the Continental Roll & Steel Foundry Co. For the past five years Mr. Sternberg has been general superintendent of the Hubbard Steel Foundry Co., East Chicago, Ind., now a division of Continental.

M. C. Suerken has become New York office sales representative for the Reliance Electric & Engineering Co., 1042-1090 Ivanhoe Road, Cleveland, Ohio. Robert M. Fitzgerald has been made sales representative, Philadelphia office.

John J. Walsch, formerly superintendent of the electric steel foundry of Crucible Steel Casting Co., Lansdowne, Pa., has become works manager for the Clark Equipment Co., Buchanan, Mich.

H. Chandler Werbe was elected president of the Lynch Machine Co., Anderson, Ind., at the recent annual meeting. Edward Bridges was elected vice-president and general manager and Jesse L. Watts was elected secretary-treasurer.

C. F. Wiley has been appointed manager of sales, electrical and wire rope department, American Steel & Wire Co., Chicago, to fill the vacany caused by the death of C. S. Knight.

Frank C. Reed, General Sales Manager of the Westinghouse Electric Elevator Co., has been elected vice-president to succeed R. I. Phillips, resigned. He has been associated with the Westinghouse Electric & Manufacturing Co., since 1903, when he was graduated from college.

Dr. Victor O. Homerberg
who presented a paper April 14, at the Spring Sectional Meeting, New England chapters, A.S.S.T.

John F. Blackie, for the past six years manager of manufacturing activities of the National Enameling & Stamping Co., St. Louis, has been appointed executive vice-president, a newly-created position. He will divide his time between the Milwaukee, Granite City, Ill., and other works of the company.

OBITUARIES

William Ganschow, 55, Second Vice-president of Gears & Forgings, Inc., Cleveland, Ohio, died suddenly at his home in Chicago April 7. He had been president of the William Ganschow Co., Chicago, until 1928, when it was merged with other companies to form Gears & Forgings, Inc., for which he was placed in charge of Chicago operations.

George A. Adsit, retired general superintendent of the Benjamin Eastwood Co., Paterson, N. J., where he had been employed for some 30 years, died March 26. He had many patents to his credit and had been a subscriber to *American Machinist* for almost 50 years.

James B. Bonner, 67, Philadelphia district sales manager for the Carnegie Steel Co., and during the war vice-chairman of the committee on steel distribution of the American Iron & Steel Institute, died April 8 in Philadelphia.

Frederick W. Bruch, 79, Cleveland manufacturer and pioneer in the field of bolt and nut machinery, died April 1. He was one of the organizers of the Acme Machine Co., which began as a partnership of Mr. Bruch, Claus Greve, and Daniel Luehrs.

Stanton R. Costley, affiliated for 30 years with the sales department of the J. S. McCormick Co., Pittsburgh, manufacturer of foundry equipment, who retired several years ago, died recently in Florida.

H. Stockwell Day, 41, President of Day-Martin, Ltd., Montreal, was killed in an automobile accident in Montreal on March 29. Mr. Day was vice-president of Aero-Engines of Canada, Ltd., and a director of Bellanca Aircraft of Canada, Ltd., and of Aircraft Industries of Canada.

W. A. Flint, 69, President of the Lay-More Tile Machine Co., Crawfordsville, Ind., died at his home in Vincennes, Ind., recently, after a long illness.

Nelson S. Greensfelder, 40, Advertising Manager of the Hercules Powder Co., and nationally known authority on industrial advertising, died in Wilmington, Del., on April 5 after a short illness with pneumonia.

William A. Harris, 74, prior to his retirement in 1903 president of the Baush & Harris Machine Tool Co., Springfield, Mass., died there April 5.

William C. Holzworth, 43, associated with the Pittsburgh office of E. J. Lavino & Co. for the past ten years, died at Pittsburgh, April 2.

Jacob G. Joseph, 70, President and Founder of the Buffalo (N. Y.) Steel Co., died April 2 in Buffalo. He had been head of the company since its organization 31 years ago.

Franklyn Kilshaw Irwin, 71, retired mechanical engineer of Philadelphia, died there April 6. He was formerly connected with the Philadelphia office of the Combustion Engineering Corporation.

Dr. Wiley Lyon Kingsley, 64, former president of the Rome (N. Y.) Manufacturing Co., Rome Brass & Copper Co., Rome Metal Co., Rome Locomotive & Machine Works, and the Rome Turney Radiator Co., died unexpectedly April 6 at Palm Beach, Fla.

Francis Kernan, 78, former president of the Syracuse (N. Y.) Stove Co., died there April 8.

Alexander Lackman, 73, Factory Superintendent of the Emery Manufacturing Co., Bradford, Pa., died there recently. He had retired in 1929.

Andrew Ellicott Maccoun, 58, superintendent of the Edgar Thomson Steel Works in Braddock, Pa., died of pneumonia April 4 in Pittsburgh.

William H. Rehm, 65, President of the Winslow Boiler & Engineering Co., Chicago, died April 8.

W. S. Robertson, 70, associated with the Combustion Engineering Corporation, New York, in sales work since 1912, died March 31 at Newark, N. J.

Thomas L. Routh, 64, Secretary and Treasurer of the Buckingham-Routh Co., New Haven, Conn., died April 4.

Edwin S. Slatery, 59, retired president and general superintendent of the Muncie (Ind.) Foundry & Machine Co., for the past 20 years, died April 3 in Indianapolis. He established the Muncie Company in 1909.

James Lorne Weir, Secretary-Treasurer of the firm of J. and R. Weir, Ltd., marine engineers, died suddenly at his home in Montreal on April 3.

FORTHCOMING MEETINGS

National Metal Trades Association—33rd Annual Convention, Hotel Sinton, Cincinnati, Ohio, April 15-16.

American Society of Mechanical Engineers—Calvin W. Rice, executive secretary, 29 West 39th St., New York. The following meetings are scheduled:

Semi-Annual meeting, Birmingham, Ala., Apr. 20-23, 1931.

National Aeronautic Meeting, Baltimore, Md., May 12-14, 1931.

National Applied Mechanics Meeting, Purdue University, Lafayette, Ind., June 15-16.

American Welding Society—Annual Meeting, April 22-24, New York City. M. M. Kelly, 33 West 39th St., New York, Secretary.

Steel Founders' Society of America — Monthly Meeting, Pittsburgh, April 23. Granville P. Rogers, 432 Graybar Bldg., New York City, Managing Director.

American Foundrymen's Association—Annual convention and exhibition, Stevens Hotel, Chicago, May 4-8, 1931, C. E. Hoyt, 222 West Adams St., Chicago, secretary.

Society of Automotive Engineers—Annual Spring Production Meeting, May 7-8 at Hotel Schroeder, Milwaukee. J. A. C. Warner, 29 West 39th St., New York, N. Y., Secretary.

American Gear Manufacturers' Association—Annual Spring Meeting, Hotel Statler, Buffalo, May 7-9, 1931. T. W. Owen, 3608 Euclid Ave., Cleveland, secretary.

American Steel & Heavy Hardware Association — Twenty-second Annual Convention, May 18-20, William Penn Hotel, Pittsburgh. B. R. Sackett, 505 Arch St., Philadelphia, Secretary.

National Foreign Trade Council—Annual Convention, May 27-29, at the Hotel Commodore, New York City. O. K. Davis, secretary, 1 Hanover Square, New York, N. Y.

American Management Association—Annual Conference, Production Division, Rochester, N. Y., June 1-2. Headquarters, 20 Vesey St., N. Y. C.

National Association of Purchasing Agents—Annual Convention and Informashow, Royal York Hotel, Toronto, Canada, June 8-11. G. A. Renard, 11 Park Place, New York.

National Association of Foremen—Eighth Annual Convention, Biltmore Hotel, Dayton, Ohio, June 12-13. Detailed information from the National Association of Foremen, Refiners Bldg., Dayton, Ohio.

Society of Automotive Engineers—Summer meeting, June 14-19, White Sulphur Springs, Va., Green Brier Hotel. J. A. C. Warner, Secretary, 29 West 39th St., New York City.

American Society for Testing Materials—Annual Meeting, Stevens Hotel, Chicago, June 22-26. C. L. Warwick, 1315 Spruce St., Philadelphia.

American Institute of Electrical Engineers—Annual Summer Convention, June 22-26, Asheville, N. C. F. L. Hutchinson, 33 West 39th St., New York, N. Y., secretary.

THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine tool business

NEW YORK

Spottiness remains the order of the day in machine tool markets here. Buying being done is usually the result of absolute need. One or two dealers had a week decidedly better than previous ones, while others showed a slight slowing up, maintaining the average about where it has been. Inquiries are steady to better, and some dealers see encouragement in the fact that more smaller prospects are submitting inquiries. Tools purchased are of the cost-reducing variety, most of them being special tools. Sales are being made to electrical manufacturers now and then, but they do not need much. Railroad demand is absent.

DETROIT

There has been little change in the machinery and machine tool market here in the last few weeks. It is still spotty, with little indication of immediate improvement. The general belief seems to be that the third quarter will provide much better conditions. Most dealers are working hard to get what business there is, but industrialists are extremely conservative in all buying.

The optimism that has prevailed in most lines of business for several weeks seems to have taken a drop. A note of depression has crept back into the public psychology. There is very little in the way of new business in sight; inquiries are fairly numerous, but few of them result in actual orders. This seems to be a period of marking time.

NEW ENGLAND

Machine tools needed and machine tools sold are apparently miles apart. The fact is machinery required cuts little ice in the New England sales volume. This matter of needed equipment has taken a quiet fade out, so frequently following quotations, that a few new inquiries, more or less, cause little stir. Selling machine tools right now is a man-sized job.

Some dealers, however, report, improvement thus far in April. Others encounter the same tight purse strings, with orders forthcoming only after urgent need. Amtorg continues to be interested in New England built machinery and supplies about all of the recent high lights. Business conditions show gains. Unemployment in Connecticut, Rhode Island, and Massachusetts has declined noticeably.

CHICAGO

While not actually warranting a forecast that business in machine tools has reached a point beyond which a steady and more active market may reasonably be expected, the first days of April have brought encouragement. Inquiries are on the increase, and closing on several railroad units is reported. Making up for the cessation of railroad inquiry noted a week ago, four roads have come into the market within the last few days, two of them with lists of major importance. These are the Chicago, Milwaukee, St. Paul & Pacific, and the Union Pacific. The former lists 43 items, roughly estimated at a total value of between $60,000 and $75,000, and embracing tools of diversified types. The Union Pacific list contains 12 items, valued at between $15,000 and $20,000, and includes a grinding machine, a buffing machine, an axle burnishing lathe, an engine lathe, and a portable cylinder boring machine, most of the items being for the road's Omaha shops. The Northern Pacific is asking prices on an engine lathe, and the Santa Fé on a manufacturing-type drill press. Industrial inquiry seems to be making little, if any, progress.

MACHINERY and machine tool markets remain undecided. Generally, districts show little change, but certain sections show some upturn. The situation is analagous to that of a group of small boys ringing last year's swimmin' hole. All are ready to go in, but a leader is lacking. Meanwhile, obsolescent equipment continues to increase, and purchasers will find themselves in the same situation in which they were two years ago —all in need of tools with deliveries averaging ten weeks to three months, and prices decidedly higher.

NEW YORK remains spotty, with little railroad demand, and some increase in inquiries from small prospects for small tools. Detroit's market is also leopardlike, the last several weeks' optimistic attitude seemingly having been dampened. Buffalo, on the contrary, reports improvement, some of it being school equipment. New England has some dealers reporting upturns, others holding about even; unemployment is declining, and foreign demand is maintained. Cincinnati holds even also, with no features. Chicago, boasting four new railroad inquiries and some railroad closures, reports that the C.M.St.P.&P. wants 43 items, about $60,000 worth of tools.

INDIANAPOLIS also has spotted fever, general machinery going well but machine tools slowly, while inquiries are increasing. Canada reports a pronounced gain, with metal-working schedules being stepped up. Los Angeles has prospects, but no change in the business situation. All-in-all, purse strings seem fitted with combination locks, to which someone has lost the combination.

CINCINNATI

A few machine tool manufacturers report business a shade better the past week, but on the other hand a few report a slight falling off. The majority report business "as was," which means that users continue to fail to respond to strenuous sales effort. Local selling agents report that while there has been no important market change they see some signs of a "break" for the better in the near future. The week's sales were almost entirely confined to single items, bought by various classes of users, the orders being well scattered and the requirements well diversified. Inquiries, of which there were a fair number, were largely confined to single tools, in most cases for replacement purposes.

BUFFALO

There seems to be some improvement in the machine tool trade of western New York during the last fortnight, and it is quite generally believed that business is slowly improving. Some of the larger plants have been buying in recent weeks. While the needs of Buffalo schools have been practically filled, there are some schools outside Buffalo, Jamestown, N. Y., for example, which are equipping their manual training plants. One dealer described business as spotty. Small tool orders are quite frequent but small.

LOS ANGELES

So far as the machine tool and shop equipment business of the Los Angeles district and Southern California in general is concerned, the closing of the first quarter of the year has developed few, if any, features as compared with the preceding period. In other words there are no special details of the situation to add to the reports sent in from this district over the past several months. Among things to be hoped for are prospects of business from Boulder Dam operations when underway; from an improved oil field situation which has long been anticipated and may be achieved in due course; and possibilities of further expansion of local school and movie studio programs.

CANADA

During the last fortnight there has been a pronounced gain in demand for machinery and machine tools, especially in Ontario, Quebec, and the Maritime Provinces. With very few exceptions, the metal working industries are engaged on larger schedules than they were a month ago. This applies particularly to automotive and allied lines, while a quickening of activity is also noted in foundries and locomotive plants. Much new railway construction and improvement is to be started soon, and it is understood that further orders will be placed for rolling stock and equipment. Power equipment for hydro-electric projects is enjoying a fair demand, with prospects of extensive orders being placed during the summer months. The steel industry continues to show gradual improvement. The February output of steel ingots and direct steel castings was 43 per cent greater than January production.

INDIANAPOLIS

Machinery and machine tool business is spotty. The volume of machinery being sold appears to be very much larger than machine tools. If the trade could cash in on inquiries, the entire situation would be much improved, but there is a disposition to beat down prices and if the buyer does not get what he feels is the price he wants to pay, he just doesn't buy. The increasing number of inquiries, however, is lending some encouragement.

In some instances there is activity, and from some reason or other the two big users of machine tools are two that were not so good at this time last year. Transmission manufacturers appear to be very busy. Because of changes in models of automobiles, these manufacturers have had to change their factory lineups, with the result that considerable equipment has been sold them and more remains to be purchased.

Another bright spot is in the refrigerator business, particularly the electrically operated equipment. The General Electric plant at Fort Wayne, and the Servel and Sunbeam plants at Evansville have been buying quite a bit of equipment.

Among the users of special machinery the crushed stone and the sand and gravel plants seem to be most active. Some sales are being made to brick plants also.

BUSINESS • BAROMETER

Depressing influences, though now exhausted, are still being used as scarecrows to frighten investors

THEODORE H. PRICE
Editor, Commerce and Finance, New York

BERNARD SHAW is said to have remarked that the earth would be entirely required for an insane asylum if all the planets in the universe were inhabited. The Irishman's drollery is amusing, but it sometimes seems to find vindication in the behavior of the speculative markets or those who trade in them. This was the case last week. The depressing influences by which the markets have now been held in check for more than a year seem to have exhausted themselves, but they are still used as scarecrows to keep away the few investors who are disposed to look at the more cheerful aspect of affairs.

This is about the only rational explanation of the depressed tone of the stock and commodity markets that can be offered. They have both shown a disposition to slip away when affirmative support was withdrawn, and the railroad stocks were quite weak upon the continued decrease in earnings reported by some of the bigger companies. As it cannot be that this decrease is entirely due to the growth of air and automobile traffic, it is assumed that it reflects a falling off in trade, and business men are reluctantly compelled to adjust their hopes to the facts. But optimism is, nevertheless, in the ascendent, and distributors report a fairly active demand for most staple goods. They say that the demand for luxuries is poor, but they seem confident of a good market for staples, and in the larger department stores Easter week was relatively cheerful. The report of retail trade in March issued by the Federal Reserve Board showed a decline of only 3 per cent in dollar sales from a year ago, and as prices are much lower the volume must have been greater.

But most merchants are still disposed to delay stocking up until they feel a little more confident of an active summer trade. An expectation of better business is, however, becoming more general. The low prices to which most commodities have declined have made dealers more confident of the future. This may seem a little paradoxical, but it is nevertheless the truth.

A better demand for automobiles is reported. Production has been expanding continuously at a rate somewhat greater than the usual seasonal gain, and although output is still behind last year, the industry's leaders are confident that it will make up for lost ground later on. Iron and copper are both lower. A cut of half a cent a pound in the latter metal was formally announced, but after a day or two it was raised a quarter cent. Keener competition among the steel mills is also talked of, and well-informed dealers say that there is no likelihood of an immediate advance in the price of finished shapes. The rate of steel mill operations has been declining a little during the past two weeks, but it is probable that the spring peak is still to be reached. Contracts for structural steel have been extraordinarily large and the building figures for March are heartening. They show the largest increase over February in a good many years, and although the total is still below last year's level, part of the decline in dollar values reported is explained by lower prices.

Cotton is lower, but cotton goods are comparatively unaffected, and the mills report a fairly good business at unchanged prices. Wool is steady. Rubber is still demoralized.

THE BUSINESS WEEK

April 15, 1931

Business continues to crawl along the astonishingly flat trough that has lasted more than four months. . . . Week to week and even month to month movements are slight, sporadic, still unsignificant . . . Steel activity slides off more swiftly from its feeble spring peak, with increasing price uncertainty, but persistent hope of improved demand later from summer construction contracts. . . . Building alone evidences any vigor, but only with support of public money. . . . Other indicators are static, and our index dithers indecisively around the average of recent months, with a slight slump in the last few weeks. . . . Background conditions, excepting only encouraging crop prospects, are not conducive to confidence. . . . Stagnant or sagging security markets indicate increasing caution and indecision in anticipation of further dividend and wage readjustment. . . . Chronic weakening of commodity prices with continued credit contraction is stimulating restrictive agreements on production with governmental support or compulsion, thereby aggravating unemployment and speeding socialization. . . . Moves for major international conference action to meet the emergency and check deflation are apparently at last developing around Governor Norman's visit, but further drift and delay are likely until a third winter of unemployment looms so long as our official and financial economics emulates the ostrich, the original optimist.

©The Business Week

Probably the feature of the situation is the interest rate. About a month ago the writer of these letters advised those who used borrowed capital to secure their requirements for the next six months. Since this advice was offered the money market has been rather firmer, and during the last few days an advance of one half of one per cent in call money on the New York Stock Exchange has been reported. Of course the Federal Reserve Banks will exert their powers to keep credit abundant, but when trade begins to expand again it is not to be expected that the demand can be supplied at present cheap rates.

As the price of money is one of the most complex, yet simple, problems with which finance has to deal, it may be well to look back upon the record of the past. This record shows that when money is cheap, most borrowers expect it to go lower, and that the reverse is the case when rates are higher. Verification of this statement will be found in an interesting book by Dwight C. Rose, published by Harpers in 1928. It is entitled "Investment Management" and contains a great many facts that will interest borrowers or lenders. Among them are answers to a circular letter of inquiry issued by the Equitable Life Assurance Society of New York in 1899. In reply to this inquiry a great many American bankers expressed themselves as believing that money was not likely to go above 3 per cent during the ensuing twenty years, and not a few predicted a still further decline in the rate, which was then at or near 2 per cent per annum. But the record shows that the prophets were as usual wrong, and by 1901, the year of the Northern Pacific panic, interest rates had advanced substantially, and some of the best bonds in the market were selling on a basis of 5 or 6 per cent.

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THE WEEKLY PRICE GUIDE . . . .

Rise and Fall of the Market

BRASS and copper in fabricated forms, except copper wire, advanced materially during the week. Wire prices dropped back about ½c. per lb. in the chief markets. All other price moves in the list following were downward. Materials showing declines were black and galvanized sheets, tin, copper wire, zinc, and scrap brass and copper. Structural shapes continue in good demand; buying of other forms of steel lags. Trend in steel prices is indefinite. It is not known now whether or not recent advances will hold.

(*All prices as of Apr. 10, 1931*)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI:	
Ala. Foundry (Silicon, 1.75@2.25)	$14.69@$15.19
Tenn. Foundry (Silicon, 1.75@2.25)	14.69@ 15.19
NEW YORK:	
Buffalo No. 2 Fdry. (Silicon, 1.75@2.25)	18.25
BIRMINGHAM:	
No. 2 Foundry (Silicon 1.75@2.25)	12.00@13.00
PHILADELPHIA:	
Eastern Pa., No. 2x (Silicon, 2.25@2.75)	17.76
Virginia No. 2 (Silicon, 1.75@2.25)	17 75
Basic	17.75
CHICAGO:	
No. 2 Foundry, Northern (Silicon, 1.75@2.25)	17.50
No. 2 Foundry, Southern	17.01
PITTSBURGH:	
No. 2 Foundry	18.13@18.63
Basic	18.13@18.63
Bessemer	18.63@19.13

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.00
Cleveland	4.75
Cincinnati	4.45
New York	4.75
Chicago	4.50@4.75

STEEL SHEETS—Prices are in cents per lb. for sheets from warehouse stock except at Pittsburgh mill, where prices apply on large lots:

Blue Annealed*	Pittsburgh Mill	Chicago	Cleveland	New York
No. 10	1.90	3.35†	3.00	3.20‡
No. 12	1.95	3.45†	3.10	3.25‡
No. 14	2.05	3.55†	3.20	3.30‡
No. 16	2.15	3.65†	3.30	3.40‡
Black				
Nos. 18 to 20	2.05@2.15	3.60†	3.40	3.30
No. 22	2.20@2.30	3.75†	3.55	3.45
No. 24	2.25@2.35	3.80†	3.60	3.50
No. 26	2.35@2.45	3.90†	3.70	3.60
No. 28	2.50@2.60	4.05†	3.85	3.75
Galvanized				
No. 10	2.15@2.20	3.65†	3.50	3.35
Nos. 12 to 14	2.25@2.30	3.75†	3.60	3.40
No. 16	2.35@2.40	3.85†	3.70	3.50
No. 18	2.45@2.55	4.00†	3.85	3.65
No. 20	2.65@2.70	4.15†	4.00	3.80
No. 22	2.70@2.75	4.20†	4.05	3.85
No. 24	2.85@2.90	4.35†	4.20	4.00
No. 26	3.10@3.15	4.60†	4.35	4.25
No. 28	3.35@3.40	4.85†	4.70	4.50

*Light Plates. †400 to 3,999 lb. ‡1,000 to 3,999 lb., ordered and released for shipment at one time.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. butt..	56.14%	43.6%	53.3%	42.3%	57.3%	44.8%
3½ to 6 in. lap..	52.72%	40.18%	50.8%	37.8%	53.9%	41.4%

List prices on which foregoing discounts apply, are as follows:

Size, Inches	List Price per Foot	Diameter in Inches—External	Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.275	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.585	2.875	2.469	.203
3	.765	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28
8	2.50	8.625	8.071	.277

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness		Outside Diameter in Inches						
		½	⅝	¾	⅞	1	1¼	1½
Inches	B.w.g.	Price per Foot						
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049	18	.17	.18	.19	.20	.21	.23	.25
.065	16	.19	.20	.21	.22	.23	.25	.27
.083	14	.20	.22	.23	.24	.25	.27	.29
.095	13	.21	.23	.25	.26	.27	.29	.31
.109	12	.22	.24	.26	.27	.28	.30	.32
.120 or .125	11	.23	.25	.27	.28	.29	.31	.33
.134	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	7.00	6.00	6.15
Hoop steel	3.55†	4.00	3.65†
Cold rolled strip steel	4.95	6.00	6.10
Floor plates	4.65†	5.00	5.00†
Cold fin., round or hexagon‡	3.40	3.40	3.35
Cold fin., flat or square‡	3.90	3.90	3.85
Structural shapes	2.90†	2.95	3.00†
Soft steel bars and bar shapes	2.90†	2.95	2.90†
Soft steel bands	3.20†	3.20	3.10†
Rivets, structural or boiler	4.25	....	4.00
Tank plates	2.90†	2.90	3.00†
Bar iron (2.75 at mill)	2.90†	3.00	2.90†
Drill rod (from list)	65%	55%	60%

*Flat, 3/16-in. thick by ¾-in. wide. †Minimum, Chicago, 400 lb., New York, 1,000 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse—3/32, 8.35c. per lb.; ⅛, 7.85c. per lb.; 5/32 to ½, 7.35c. per lb.

METALS

Warehouse prices in cents per lb. for small lots:

Copper, electrolytic, New York			11.00
Tin, Straits, pigs, New York			28.00
Lead, pigs, E. St. Louis	4.25	New York	5.50
Zinc, slabs, E. St. Louis	3.90	New York	5.50

	New York	Cleveland	Chicago
Antimony, slabs	10.00	10.25	10.75
Copper sheets*	20.37½	19.87½	19.87½
Copper wire*	11.50	11.62½	11.62½
Copper, drawn, round*	18.87½	18.37½	18.37½
Copper tubing*	22.87½	22.37½	22.37½
Brass sheets, high*	17.62½	17.25	17.25
Brass tubing, high*	22.50	22.12½	22.12½
Brass rods, high*	15.87½	15.50	15.50
Brass wire, high*	17.75	17.75	17.75

*Mill, base.

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%†	24.00	24.30	23.30
Zinc sheets (casks)	9.75	11.25	10.36
Solder (½ and ½)	21.62½	21.50	18@20
Babbitt metal, delivered in case lots, New York, cents per lb.:			
Genuine, highest grade			44.50
Commercial genuine, intermediate grade			33.75
Anti-friction metal, general service			29.00
No. 4 babbitt, f.o.b.			10.00

†F.O.B.

NICKEL AND MONEL METAL—Prices in cents per lb., base, f.o.b. Huntington, W. Va.:

	Nickel	Monel Metal
Sheets, full finished	52.00	42.00
Sheets, cold rolled	60.00	50.00
Strip, cold rolled	55.00	45.00
Rods, hot rolled	45.00	35.00
Rods, cold drawn	50.00	40.00
Tubing	75.00*	90.00†
Angles, hot rolled	50.00	40.00
Plates	52.00	42.00

*Seamless. †Welded.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars:

	New York	Cleveland	Chicago
Crucible copper	7.75	7.75	6.75@ 7.25
Copper, heavy, and wire	7.00	7.50	6.25@ 6.75
Copper, light, and bottoms	6.00	6.50	5.50@ 6.00
Heavy lead	3.25	3.50	2.50@ 3.00
Lead battery plates	1.25	2.50	1.75@ 1.87½
Brass, heavy, yellow	4.00	4.50	4.00@ 4.25
Brass, heavy, red	6.75	7.00	5.75@ 6.25
Brass, light	3.25	3.25	3.25@ 3.75
No. 1 rod-brass turnings	4.50	4.50	4.00@ 4.50
Zinc	1.25	1.50	1.25@ 1.50

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07@$0.11	$0.16	$0.13
Cotton waste, colored, per lb.	.05½@.09	.12	.09
Wiping cloths, colored, per lb.	.10	....	.09
Sal soda, per lb.	.01¼	.02	.02
Roll sulphur, per lb.	.028	.03	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.	.098	.099	.106
Cutting oil, about 25% lard, in 5 gal. cans, per gal.	.75	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.	.33	.36	.24
Belting—Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin.ft., per inch of width, for single ply:			
Medium grade	30–10%	30–10%	50%
Med. grade, heavy wgt.	30%	30 –5%	40%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade	70%	50–10%	60%
Second grade	65–5%	60– 5%	65%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.029	$0.031	$0.0325
Cold fin. shafting	per lb.	.034	.034	.034
Brass rods	per lb.	.1587½	.1587½	.2125
Solder (½ and ½)	per lb.	21.62½	.22	.285
Cotton waste, white	per lb.	.07@.11	.13	.13
Disks, aluminum oxide mineral, cloth, No. 1 6-in. dia.	per 100	4.59	4.59	4.59
Lard cutting oil	per gal.	.75	.75	.75
Machine oil	per gal.	.33	.33	.33
Belting, leather, medium	off list	30–10%	30–10%	30–10%
Machine bolts, up to 1x30 in., full kegs	off list	65–10%	65–10%	50–10%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper*	$6.03	$6.03	$6.03
Emery cloth*	25.87	25.87	25.87
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper†	2.61	2.61	2.61
Cloth†	4.59	4.59	4.59
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton		Connellsville,	2.50
Coke, prompt foundry, per net ton		Connellsville,	3.25
White lead, dry	100 lb. kegs	New York,	13.25
White lead, in oil	100 lb. kegs	New York,	13.25
Red lead, dry	100 lb. kegs	New York,	13.25
Red lead, in oil	100 lb. kegs	New York,	14.75

*Less than 3 reams. †Less than 200.

SHOP SUPPLIES

Discounts from list, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less	65–10%
Larger, up to 1 x 30-in., full kegs, list less	65–10%
Less than full kegs or case lots, add to list	10%
Fitting-up bolts: list less	45%
Lag screws:	
Up to ½-in. x 6-in., list less	65–10%
Larger, list less	65–10%
Less than full keg or case lots, add to list	10%
Rivets:	
Structural, round head, full kegs, net	$4.25
Structural, round head, broken kegs, net	5.75
Tank, 7/16-in. dia. and smaller, list less	60–10%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less	65–10%
Larger, up to 3-in., list less	65–10%
Less than keg or case lots, add to list	10%
Washers:	
Wrought, full kegs, per 100 lb., list less	$3.50
Wrought, broken kegs, per 100 lb., list less	1.50
Turnbuckles:	
With stub ends, list less	20–10%
Without stub ends, list less	55%
Chain:	
Proof coil, base, per 100 lb., net	$8.50
Cast iron welding flux, per lb., net	.35
Bronzing flux, per lb., net	.50

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

N. Y., Brooklyn—Bd. of Education, R. W. Rodman, Supt. of Plant Operation, 131 Livingston St.—will receive bids until April 20 for new shop equipment in Stuyvesant High School, 345 East 15th St., New York, also machine tools, etc., in Brooklyn Technical High School, Flatbush Ave. Ext. and Concord St., Brooklyn.

Ont., Niagara Falls—Sangster Lumber Co. Ltd. C. R. W. Sangster Mgr.—saw mill equipment.

Ont., Oakville—Heaters of Canada Ltd.—complete equipment for the manufacture of radiators for steam and hot water heating, etc.

Ont., Welland—A. W. Delaplante Co. Ltd.—machine shop equipment.

Opportunities for Future Business

Conn., Newington—Keeney Mfg. Co., Main St., awarded contract for the construction of a 45 x 120 ft. addition to factory on Main St. Estimated cost $40,000 including equipment.

Conn., New London—B. Bottinelli, Broad St., awarded contract for the construction of a 1 story, 85 x 135 ft. garage. Estimated cost $40,000. Noted Mar. 19.

Conn., New London—Bureau of Yards & Docks, Navy Dept., Washington, D. C., received lowest bid for the construction of a Diesel engine laboratory at Naval Submarine Base here, from C. Smith & Sons, 101 Water St., Darby, $24,900. Noted April 2.

Conn., Waterbury—Kaplan Bros., 352 East Main St., revising plans for a 1 story service garage, etc., on East Main St. Estimated cost $40,000. T. M. Freney, 69 Center St., Archt. Former bids rejected. Noted Mar. 19.

D. C., Washington—D. C. Commissioners, will soon award contract for the construction of an auto repair shop at Columbia Junior high school.

Ill., Peoria—Peoria Public Schools, E. C. Fisher, Supt., plans the construction of a 3 story junior high school including shops, etc., on Warren St. Estimated cost $800,000. Hewitt, Emerson & Gregg, Peoria Life Bldg., Archts. Maturity late summer.

Ind., Gary—American Sheet & Tinplate Co., will build addition to plant. Estimated cost $50,000. Private plans. Work will be done by owners forces.

Ind., Terra Haute—Terra Haute Malleable & Mfg. Co., is having plans prepared for addition to foundry. Estimated cost $40,000. Private plans.

Ia., Harper—Continental Construction Co., c/o H. L. Doherty & Co., 208 South La Salle St., Chicago, Ill., awarded contract for an 88 x 146 ft. compressor station, auxiliary building, storage warehouse, shops, garages, etc. Estimated cost $200,000.

Ia., Iowa City—Iowa State University, c/o State Bd. of Education, State House, Des Moines, awarded contract for the construction of a mechanical engineering laboratory. Estimated cost $60,000.

Ky., Russell—Chesapeake & Ohio Ry. Co., Terminal Tower, Cleveland, O., plans additions to terminal yards, a classification yard, etc. here. Estimated total cost $525,000. C. W. Jones, Richmond, Va., Ch. Engr.

Md., College Park—Smith & May, Baltimore Trust Bldg., Archts., will receive bids until April 21 for the construction of a 3 story, 66 x 115 ft. engineering building for University of Maryland.

Mass., Cambridge (Boston P.O.)—Riverside Boiler Works, Inc., 50 Harvard St., awarded contract for addition and alterations to factory, 3 story, 75 x 105 ft. on Harvard St. Estimated cost $40,000.

Mass., Longmeadow—Town, F. E. Smith, Clk., will soon award contract for a 1 story, 50 x 125 and 40 x 40 ft. municipal work shop on Pondside Rd. Estimated cost $40,000. R. W. Mowry, 25 Harrison Ave., Springfield, Archt. Noted April 9.

Mass., Newton (Br. Boston)—Newton Buick Co., R. Dwyer, Pres., 371 Washington St., is receiving bids for a 1 story, 65 x 105 ft. sales and service station at 378 Washington St. Estimated cost $40,000. Private plans.

Mass., Peabody—Carr Leather Co., 111 Foster St., is receiving bids for the construction of a 5 story, 45 x 100 ft. leather factory. Estimated cost to exceed $40,000. Private plans.

Mass., Pittsfield—J. Aubry, Pollock Ave., had plans prepared for the construction of a 3 story, 105 x 130 ft. garage on Summet St. Estimated cost $175,000. G. E. Haynes, 29 George St., Archt. Noted Sept. 25, 1930.

Mich., Detroit—Dept. of Water Supply, awarded contract for the construction of a power plant including part of boiler plant, machine shop, store house, garage, etc., for Springwells water system, West Warren Ave. $983,320.

Minn., St. Paul—First National Bank, E. A. Tyler, Dir. of Const., 602 Merchants National Bank Bldg., will soon award contract for the construction of an 8 story, 100 x 130 ft. garage at 4th and Minnesota Sts. Estimated cost $350,000. Ellerbe & Co., 525 Minnesota Bldg., Archts.

Mo., St. Louis—Bd. of Police Commissioners, L. O. Hocker, Pres., will receive bids until April 17 for the construction of a 2 story, 112 x 134 ft. police station and garage at Kansas Ave. and Colorado St. Estimated cost $150,000. Klipstein & Rathmann, 316 N. 8th St., Archts.

Nev., Boulder City—Bureau of Reclamation, Dept. of Interior, Denver, Colo., is having preliminary plans prepared for the construction of a school building, garage, etc., here. R. F. Walter, Denver, ch. engr.

N. J., Jamesburg—Bd. of Education, will receive bids about June 1 for the construction of a 2 story high school including manual training department, etc. Estimated cost $150,000. J. N. Pierson & Son, 198 Jefferson St., Perth Amboy, Archts.

N. J., Jersey City—J. Goldenberg, 80 Woodland St., Englewood, is having revised preliminary plans prepared for a 4 story garage, etc., at Sip and Summit Aves. Estimated cost $150,000. C. Shilowitz, 26 Journal Sq., Archt. Noted Feb. 19.

N. J., Newark—Art Metal Works, L. V. Aaronson, Pres., 7 Mulberry St., awarded contract for alterations and additions to buildings No. 1 and 13 at 9-29 Mulberry St. Estimated cost $40,000.

N. J., Newark—Unique Art Mfg. Co., 196 Waverly Ave., is having plans prepared for the construction of a 2 story factory. Estimated cost $100,000. S. Saul & Co., 24 Commerce St., Archts. and Engrs. Noted Feb. 12.

N. Y., Brooklyn—F. Calahrese, 1612 2nd Ave., New York, is having sketches made for the construction of a 1 story, 100 x 110 ft. service garage at Fenimore St. and East Albany Ave. here. Estimated cost $40,000. D. S. Lang, 1860 Broadway, New York, Archt.

N. Y., Brooklyn—Caspar Realty Corp., 6117 4th Ave., is having sketches made for a 1 story, 100 x 100 ft. service garage at 4th Ave. and 63rd St. Estimated cost $40,000. D. S. Lang, 1860 Broadway, New York, Archt.

N. Y., Brooklyn—P. & C. Building Corp., I. Palatnik, Pres., 1630 Carroll St., is having sketches made for a 1 story, 100 x 140 ft. service garage at Ave. I and East 35th St. Estimated cost to exceed $45,000. H. J. Nurick, 44 Court St., Archt.

N. Y., Brooklyn—T. L. E. G. Construction Corp., M. Goodman, Pres., 65 Court St., is having sketches made for the construction of a 1 story, 98 x 100 ft. service garage, etc., at Oakland and Box Sts. Estimated cost $40,000. M. Klein, 65 Court St., Archt.

N. Y., Flushing—A. Beaudel, 140-34 Brookville Blvd., Rosedale, will receive bids after May 15 (extended date) for the construction of a 2 story repair shop at Brookville and Conduit Blvds. here. Estimated cost $40,000. Private plans. Noted Mar. 12.

N. Y., Jamaica—Wohlbro Improvement Corp., 149-27 Jamaica Ave., will build a 100 x 104 ft. service garage, auto laundry, etc., at 116th Ave. and Merrick Blvd. Estimated cost $40,000. A. McLean, 149-27 Jamaica Ave., Archt. Work will be done by day labor and separate contracts. Noted Mar. 26.

N. Y., Long Island City—Dept. of Sanitation, Municipal Bldg., New York, awarded contract for the construction of a garage here. $91,900. Noted Feb. 26.

N. Y., Long Island City—Dept. of Water, Gas & Electricity, Municipal Bldg., New York, will probably receive bids in May for a 2 story, 52 x 150 ft. shop, etc., at Dryer and Packard Sts. here. Estimated cost $50,000. D. Campbell, 154 Amity St., Flushing, Archt. Noted April 9.

N. Y., New York—S. Cincelli, 2393 Arthur Ave., will receive bids about May 15 for the construction of a 1 story, 90 x 119 ft. service garage at Hoffman and 184th Sts. Estimated cost $40,000. M. W. Del Gaudio, 545 5th Ave., Archt. Noted Apr. 9.

N. Y., New York—Navone Bros., 17 Leroy St., is having sketches made for the constructinon of a 4 story, 50 x 180 ft. garage, etc. at 18 Morton St. Estimated cost $150,000. M. W. Del Gaudio, 545 5th Ave., Archt.

N. Y., New York—Thirty West End Corp., N. Wallenstein, Pres., 33 West 142nd St., is having sketches made for a 4 story, 99 x 100 ft. storage garage at 28 West End Ave. Estimated cost $150,000. W. Shary, 22 East 17th St., Archt.

N. Y., New York—Webster Auto Wrecking Co., B. Cohen, Pres., Carter Ave. and 174th St., is receiving bids for a garage and repair shop. Estimated cost $40,000. W. I. Hohauser, 17 West 44th St., Archt. Noted April 9.

O., Barnesville—Lotus Glass Co., plans the construction of a 1 story, 30 x 60 ft. factory unit to provide added facilities for decorating and silver departments. Estimated cost $40,000.

O., Cleveland—John Carroll University, J. J. Bernett, Chn. of Building Committee, West 30th St. and Carroll Ave., awarded contract for a group of buildings including 80 x 248 ft. administration building, 46 x 111 ft. service building, etc. on Washington Blvd. Estimated cost $2,500,000.

O., Cleveland—Gulf Refining Co., c/o E. H. Gibson, Asst. Engr. of Constr., Battery Park Bldg., New York, N. Y., plans the construction of a 23 steel plate tank, 8,154,600 gal. capacity, also 100 x 166 ft. warehouse, 85 x 156 ft. garage, 40 x 60 ft. machine shop and boiler house, etc. Estimated total cost $1,000,000.

O., Cleveland—J. C. Virden Co., 6103 Longfellow Ave., manufacturers of electrical goods, awarded contract for a 2 story, 35 x 152 ft. addition to factory. Estimated cost $40,000.

O., Warren—United States Gypsum Co., 111 West Washington St., Chicago, Ill., plans the construction of a 1 story factory for the manufacture of patented metal arch on Phoenix Rd. here. Estimated cost $100,000.

Pa., Oil City—Empire Oil Works, W. J. Scott, Reno, is having plans prepared for the construction of a 1 story, 30 x 40 ft. service station, 40 x 120 ft. accessory building and garage at State and Second Sts. Estimated cost $50,000. Brenot & Hicks, Traymore Bldg., Oil City, Archts.

Pa., Pittsburgh—I. Slutsky, Stanton Ave., is having plans prepared for the construction of a 3 story, 130 x 130 ft. garage at Third Ward. Estimated cost $50,000. H. Ginsburg, Plaza Bldg., Archt.

Tex., El Paso—Nichols Copper Co., 25 Broad St., New York, N. Y., c/o J. P. Dwyer, Mgr., P. O. Box 1372, El Paso, Tex., plans the construction of a rod mill and copper wire factory here. Estimated cost $1,500,000.

Tex., San Antonio—Sealy Mattress Co., c/o N. Deeben, 1002 South Medina St., plans to expend $275,000 for improvements to plant. Private plans. New equipment and facilities will be required.